Electrical Review

WITH WHICH IS CONSOLIDATED WESTERN ELECTRICIAN AND ELECTROCRAFT

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Fig. 1.—Boiler Room at Oneida Street Station, Showing Furnaces, Feed Lines, Instrument Boards and Furnace Inlets.

Pulverized Coal in a Milwaukee Power Plant

Plant Layout, Methods and Special Features of Oneida Street Station of Milwaukee Electric Railway & Light Co.—Details of Equipment and Sizes of Motors Used—Data on Operating Experiences

The Milwaukee Electric Railway & Light Co is operating five 468-hp. water-tube boilers with pulverized coal exclusively. This installation has now been in service many months with entire satisfaction, operating under actual operating conditions and supplying steam as demanded by the company's system. At the time pulverized coal apparatus was first used by the company it was chiefly as an experiment, and for this reason existing space at the company's Oneida Street station was put to use by taking out some apparatus already in use and substituting that for using pulverized coal. The layout at the Oneida street station is, therefore, somewhat of a compromise between just what would be best and what was possible.

The coal used by the Milwaukee Electric Railway & Light Co. is transported by water. It is unloaded by grab bucket and dumped into hoppers for the green coal. From the green coal hopper it is passed over a magnetic separator, over a scale for weighing purposes and then to

the crusher, from which it is elevated by a bucket conveyor to the hoppers. A 20-hp. squirrel-cage motor operates the separator, crusher and elevator. There is one raw coal bin per boiler, an arrangement that enables each boiler to be treated separately during tests. The accompanying isometric view shows the general layout of the station and the path of travel followed by the coal from the time it enters the station until it goes to the furnace.

From the green coal storage bins the coal is passed by means of a screw conveyor horizontally and then vertically by the disintegrator and drier, where the coal is dried so that not more than 1 to 2% of moisture remains. The drier is heated by a separate furnace located beside it. The drier measures about 65 ft. long by 6 ft. in diameter, and slowly revolves, working the coal gradually toward its lower end where it is picked up by a screw propeller and passed to the bucket conveyor which carries it to the dried-coal storage bin. The drier is driven by a 30-hp., variable speed, d-c. motor, which also drives the moisture exhauster, dust collector and cyclone separator. The elevator handling the dried coal is a 5-hp., d-c., constant-speed motor. From the dried-coal storage bin the coal is fed by gravity to the pulverizing mills, of which there are two, one being for reserve. Each mill is driven by a 75-hp., constant-speed, d-c. motor. A suction fan, one for each mill, is driven by a 40-hp., squirrel-cage motor. When the coal has passed through the pulverizer it is of such size that from 80 to 85% will pass through a 200-mesh screen. The coal is then conveyed to the pulverized coal bins by means of a screw conveyor, which is driven by a 5-hp., d-c., constant-speed motor. There are two pulverized coal bins per furnace, an arrangement that permits either one to be taken out of service, with its feed lines.

Each pulverized-coal storage bin, located immediately above the furnace it serves, is connected to a steel coal feed line and an air-mixing chamber. The coal from storage moves by gravity to a screw conveyor located beneath it and driven by a 1½-hp. motor, d-c., variable-speed motor (there are ten of these 1½-hp. motors, since there are ten pulverized coal bins). The coal is moved along to the mixing chamber, at which point air under pressure from forced-draft blowers enters the chamber. From this point the coal dust is carried by air to the burner, the air not only picking up the coal, but mixing with it and thus preparing it for efficient combustion. The accompanying illustration shows the pulverized coal bins, motor-driven screw conveyors, air-mixing chamber and feed lines.

Forced draft for supplying the air needed to carry the coal dust and also shoot the coal at high velocity through the burner is supplied by means of two motor-driven blowers located in the boiler-room aisle. Each of these is driven by a 15-hp., d-c., variable-speed motor capable of delivering air against a pressure of 7 ins. of water. Only one blower is used at one time. Beside the blower control are also the control rheostats for regulating the supply of coal fed the burners by changing the speed of the screw conveyors already mentioned. In referring to the illustration of the blowers, the suspended sheet-steel gallery or platform deserves mention. This gallery is supported by angle irons and is to permit ready access to the air-mixing chamber and the screw-conveyor motors.

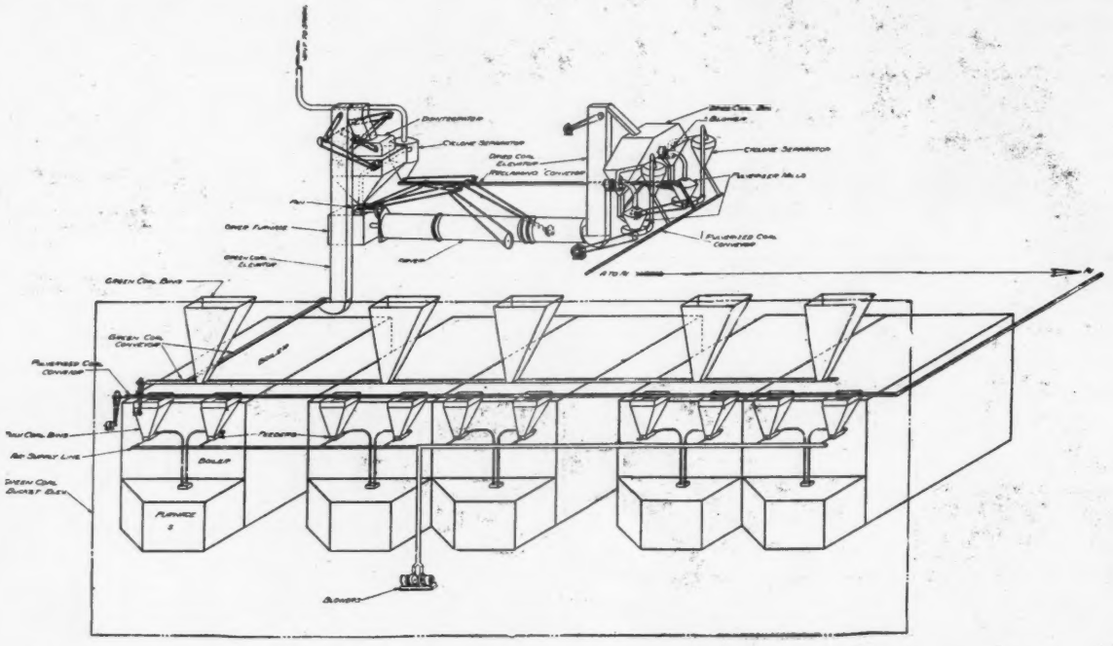


Fig. 2.—Isometric View of Oneida Street Station, Showing Location of Apparatus and Routing of Coal.

Relative Location of Equipment.

The cross-sectional elevation of the Oneida Street station shows the relative location of the various pieces of equipment comprising the whole. It also gives a good view of the furnace, its shape and size. The furnace has 1678 cu. ft. of combustion space and the distance from the bottom of the furnace to the bottom row of tubes is 15 ft. It will be seen that the burner enters the furnace vertically, an arrangement that for the furnace chamber shown favors high com-

bustion efficiency because of the good mixing of air and coal. At the same time it lessens any troubles that might develop with the brickwork since the flame does not impinge directly upon the brickwork and the flame length is increased.

The coal and ash conveyor seen to pass along the bottom of the furnace was placed there because it was impossible to re-locate this in the existing space. The protruding wall shown protects the conveyor, but suffers rather from high temperatures, a condition not strictly chargeable to pulverized coal or furnace chamber design but to the fact that an existing station had to be modified to suit new conditions. This is the only portion of the brickwork that has given any sign of trouble, although the boilers are operated at 200% rating for long periods at a time and have been operated at 180% rating for several days continuously to determine the success of the existing furnace design. The furnace was designed five times before the present success materialized, however. The fact that the coal is fed down vertically is believed to be responsible for the entire absence of tube troubles as well as refractory difficulties and the good combustion efficiency always obtainable. The long flame that results neither impinges on brick or tube, giving uniform heat without blow-torch effects. The large furnace volume is likewise a factor, the present volume being about five times that ordinarily found with stoker-fired installations.

The air openings in the furnace walls seen in the illustration of the furnaces, Fig. 1, serve a two-fold purpose. There are twelve of these inlets for air, five being above and seven below the boiler-room floor. Air is drawn in by suction, as with induced draft, because of the partial vacuum existing in the furnace. Just how much air is taken into the furnace in this way depends upon the draft or damper setting for a given opening of the furnace vents. These vents are used not only for improving the combustion but for cooling off the brickwork, a purpose that is largely responsible for the satisfactory life of the latter.

Instrument Panels.

Between each pair of boilers is located an instrument board which carries the instruments for two boilers (Fig. 1). The instruments are so located with respect to the control mechanisms for regulating the stack damper that the one can be co-ordinated to the needs of the other.

Each boiler is equipped with a General Electric steam-flow meter, a Precision recording draft gauge for recording draft over the fire and in the last pass, a Precision indicating draft gauge for indicating the above, and a Bristol recording thermometer for recording stack temperatures and steam temperature. A Euhling draft gauge is installed on each board to permit the other draft gauges being easily checked against it.

A Precision CO_2 recorder, which is piped to all five boilers, is located in the boiler-room aisle. Usually this instrument is placed on a boiler for two or three hours at a time when a change is made to some other boiler. The gases are picked up in the third pass, immediately below the damper. A smoke recorder is also installed and serves the stack that cares for all five boilers using pulverized coal and a number of other boilers using mechanical stokers that use the same stack.

Operating Experiences with Pulverized Coal.

The Oneida Street station has been in operation a sufficient length of time to prove that the burning of pulverized coal is satisfactory, reliable and also economical. Certain facts have been found out about the use of pulverized coal,

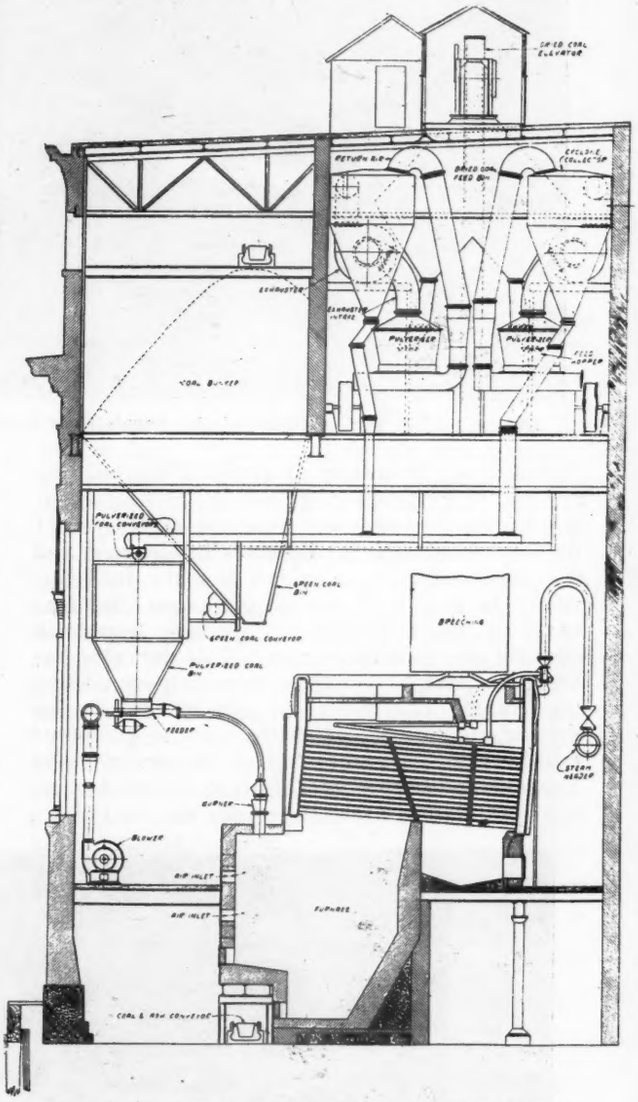


Fig. 3.—Cross-Sectional Elevation of Oneida Street Station.

and if these are attended to, there is no trouble; if they are not attended to, trouble can be expected.

One of the first facts brought out when the station started up was the necessity of having the pulverized coal dry all the time that it was passing through the coal feed lines. If the coal was not dried sufficiently in the drier, or picked up moisture on its way to the burners, the coal would pack, adhere to the pipes and finally become immovable. This trouble has been overcome by more complete drying, to within 1 or 2% of moisture, and preventing moisture from entering the feed lines.

Another fact brought out was that the supply

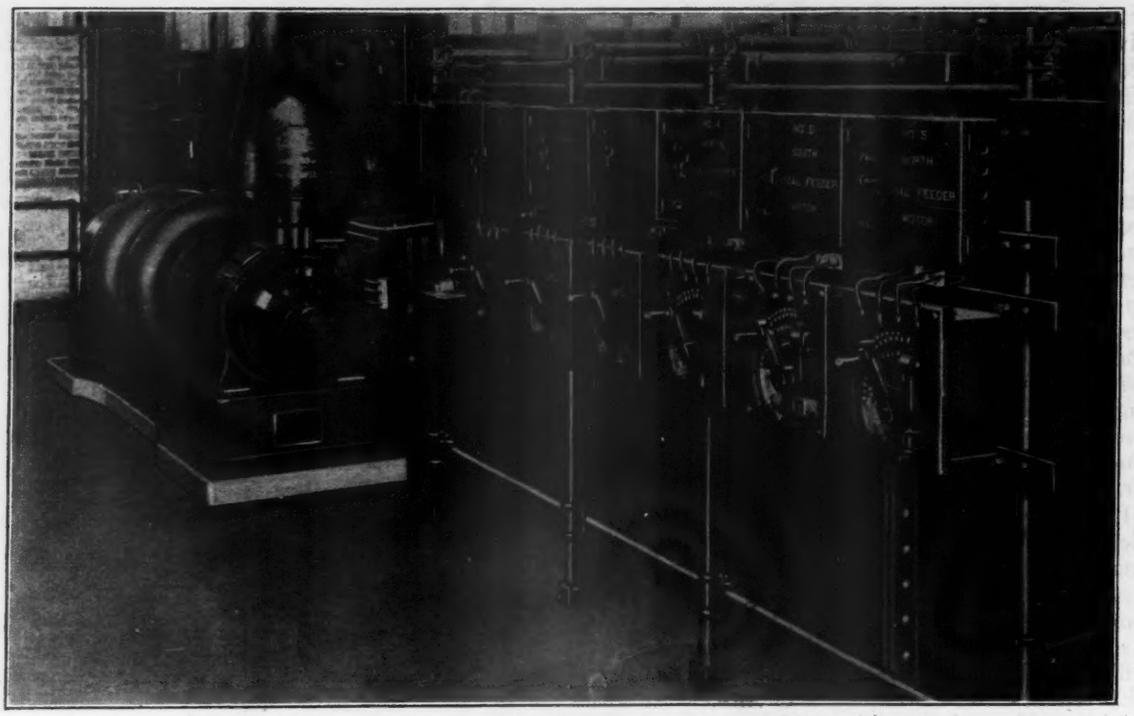


Fig. 4.—Control Panels for Regulating Forced-Draft Blowers and Powdered Coal Feeders.

of coal and the supply of air used for burning and also carrying the coal from the mixing chamber to the burner must continue together. If for any reason the air becomes interrupted and the coal continues to be fed into the feed line where forced draft no longer exists, the coal packs up and clogs the pipe, causing trouble in opening the feed line again. This difficulty has been very simply overcome by merely connecting the control circuit of the 1½-hp. motor for driving the screw conveyors for the powdered coal with the control circuit of the motor-driven blowers so that if the blowers or mechanical draft fails, the screw conveyors are shut down automatically. These are merely a few examples of some of the many interesting operating experiences brought out in operating the largest installation of pulverized-coal burners under steam boilers in the world.

Operation at the Oneida Street station has been so satisfactory that the Milwaukee Electric Railway & Light Co. has already under construction another station which will be known as the Lake Side station, where pulverized coal will be employed exclusively. The plant will contain, at first, eight 1306-hp. water-tube boilers. The company plans to have this plant in service before next winter.

Fig. 5.—Pulverized Coal Bins, Feed Lines and Top of Furnaces.

Extensive Electrical Construction Planned for 1920

Survey Among Central-Station Companies Shows Vast Expenditures Will Be Made for New Plants, Improvements, Additions and Extensions to Transmission Lines and Distribution Systems During Year

Construction work mounting into hundreds of millions of dollars is now in progress, or contemplated during this year, by electric light and power companies and other organizations operating in the electrical public utility field. This work is being undertaken despite the fact that in many instances public utility companies are finding it hard to obtain the necessary financial backing for new development work.

The work consists of the building of new power plants, installation of new equipment, construction of new transmission lines and betterments to existing plants. By far the greater part of the work will be in the construction of new power plants and transmission lines.

The development of transmission lines for supplying energy to farms is occupying the attention of a great many companies, particularly in suburban sections, but in most cases the companies are not expending money in this direction. Instead they are inducing the farmers to finance the construction of the lines.

In the larger industrial centers, such as Detroit, Cleveland, Pittsburgh and other cities, the greater part of the new development work is for the taking care of the extra demands for power by the many industrial concerns that have built new plants or enlarged their old ones, and are using electric energy for power. In many instances manufacturing plants have shut down their own power plants and are using central-station service, while in other cases central-station service is used as an auxiliary power to that developed by the manufacturing plant.

A survey of some of the new construction work in all sections of the country folllows:

Duquesne Light Co. Has $14,800,000 Worth of Construction Work Under Way.

New construction work amounting to $14,800,000 in the vicinity of Pittsburgh is already under progress by the Philadelphia Co., operating the Duquesne Light Co., and subsidiary companies in Pittsburgh, including new power-plant units, building of high-tension transmission lines and erection of six new substations. The biggest new development by the company is the building of the Cheswick Power Co., Colfax, Pa., plant, located 10 miles north of Pittsburgh on the Alleghany river. The energy produced by this plant will be sold to the Duquesne Light Co. The concrete foundation for the plant is about completed and it is expected that the plant will be in operation by Sept. 1, 1920, with an initial installation of 60,000-kw. The plant will cost $7,300,000 and an additional 60,000-kw. unit is to be installed by Jan. 1, 1921, at a cost of $4,000,000.

The Duquesne Light Co. is constructing a 26-mile high-tension transmission line to reach the consuming districts for the output of the Colfax plant, which will be in line with the ultimate power circuit around Pittsburgh, connecting with the Brunots Island power plant and other plants of minor importance. This work will cost $3,000,000. The company has six new substations under construction at various locations, at a cost of $500,000, to distribute the present and increased production.

In addition to the above there will be considerable renewal work and new lines both underground and overhead to serve both old and new customers. The financing of the 1920 new construction and improvements is covered by the sale in July, 1919, of $25,000,000 first-mortgage and collateral trust 30-year 6% bonds, which is part of an authorized issue of $100,000,000. In regard to materials the company states that not only are prices high but that deliveries are uncertain. The demand for electrical energy for industrial and domestic use, and more especially for manufacturing and electric furnace operations in the Pittsburgh district, is developing rapidly, reports the company and there is no doubt that business will be available for increased production. It is the intention of the Duquesne Light Co. to continue its policy of development by increasing the capacity of its present plant and constructing additional facilities as circumstances permit.

St. Cloud Public Service Co. Will Add to Its Transmission Lines.

Large extensions to transmission lines and changes of voltage on some existing lines is the principal construction work outlined by the St. Cloud (Minn.) Public Service Co. for this year. The company intends extending its lines this summer from Freeport, Minn., to Osakis, Minn., a distance of 35 miles, distributing energy at West Union and Osakis, and selling it wholesale at Sauk Centre. This line will be operated at 33,000 volts.

The company is changing the voltage on part of its lines from 16,500 to 33,000 volts, necessitating the rebuilding of 26 miles of lines between St. Cloud and Richmond, Minn. Another new work is the building of a 33,000-volt line from Regal to New London, Minn., a distance of 13 miles. The completion of the building of a 13-mile line from Paynesville to Eden Valley, Minn., work on which is now in progress, will close a 130-mile, 16,500-volt loop for the company.

At the power plant the company has added a new 3750-kv-a. steam turbine, is building a brick smokestack and also installing a new 500-hp. boiler and equipping it as well as the old

ones with automatic stokers. For the Farmers Light & Power Co., a subsidiary, the company has built in the neighborhood of 100 miles of farm lines. The company has contracted for 1600 hp. of connected load since Jan. 1, the greater part of this being for the granite industries located in and around St. Cloud.

Minnesota Company Will Make Farmers Finance Construction of Own Lines.

Wisconsin Railway, Light & Power Co., Winona, Minn., through having built a new power house in 1917 and rebuilding all its lines the same year, has sufficient capacity for its 1920 requirements and is not contemplating any new construction for its own use. The company, however, has a number of inquiries from farmers adjacent to Winona and it is possible some lines may be built into the surrounding country. This will be contingent upon the farmers financing practically the entire cost of the lines, reports the company. The demand for electric service on the part of the farmer seems to be quite general in Minnesota, according to reports, and there appears to be a growing disposition on the part of the farmer to contribute the amount necessary to make the extensions feasible. The view of the Wisconsin Railway, Light & Power Co. is that the trend is toward the farmer making an absolute donation toward the financing of the extensions, rather than the purchase of stock for that purpose, as the business secured will not carry the fixed charges on the lines.

San Joaquin Light & Power Corp. at Work on Large Water-Power Development.

Work in connection with the development of water-power projects will constitute the main activities of the San Joaquin Light & Power Corp., Fresno, Cal., in a construction way this year. The corporation is now engaged in the construction of the 30,000-kw. Kerckhoff hydro-electric plant on the San Joaquin river, which it is expected will be ready for operation and added to the system about Oct. 1, 1920. The corporation also has in contemplation the establishment of a flood-water plant, to be called the Kreckhoff Junior, about 400 ft. below the dam just completed, in the main channel of the San Joaquin river, that will give about 6000 kw. during five or six months of the year.

As an addition to the Bakersfield steam plant a 12,500-kw. steam unit is about completed. This unit will use natural gas for fuel. Orders have been placed for an additional unit of the same size, to be located near the Elk Hills gas fields in Kern county. This first unit near the gas fields is to be one of four units to follow each other as the demand for power develops.

Engineering work was completed last season on the watershed of the north fork of Kings river, that with less than 35 miles of transmission line will tie a contemplated development on that river of about 200,000 kw. to the system. The corporation is now building roads to the proposed development and expects to complete them this year so that the first units of about 32,000 kw. on this project can be built in 1921.

The corporation is also building a 110,000-volt line from the Kerckhoff plant to McKittrick, a distance of about 130 miles, tying it in with the present 60,000-volt system.

In discussing the proposed improvements the corporation states that there are some remarkable features in the development of the Kings river project. There will be two plants in excess of 2500-ft. head and all of the plants will be backed by stored flood water, equivalent to a little better than 80% load-factor, this, of course, including the stream flow for the balance of the year. The watersheds are large and run up to the extreme crest of the Sierra Nevada range of mountains. The main storage is at an elevation of 6560 ft., while the lower power house, less than 10 miles away, is at an elevation of 880 ft., the crest of the main range being around 12,000 to 13,000 ft. elevation. The watershed for all these plants embraces an area of 300 sq. miles.

Mexico Power Co. Sells $400,000 in Stock for Improvement Purposes.

The Mexico (Mo.) Power Co. is selling $400,000 worth of 7% preferred stock of the company to customers and others in the territory covered by the operations of the company and using the money to make many improvements, particularly in line extensions.

The company has just completed building a three-phase high-tension line, about 25 miles long, from Mexico to Vandalia, serving enroute the towns of Rush Hill, Laddonia and Farber. Also just completed is 10 miles of high-tension line between Centralia and Sturgeon, together with six miles of 2300-volt line to farm customers.

The company is now constructing, and will soon have finished, a 20-mile line from Mexico to Wellsville, serving enroute the towns of Benton City and Martinsburg. All material has been purchased and construction work will soon start of a 12-mile high-tension line from Mexico to Auxvasse. The above lines will enable the company to serve all the community surrounding Mexico for a radius of approximately 25 miles.

The company is now installing a 600-kw. d-c. engine-generator outfit, and also two 400-hp. high-pressure boilers and is erecting a Wiederholdt reinforced concrete and steel tile chimney 175 ft. high and 12 ft. in diameter.

Lexington Utilities Co. Is Changing System of Municipal Street Lighting.

Lexington Utilities Co., Lexington, Ky., has been engaged since the middle of last summer in changing the present municipal street-lighting system from series multiple, five lamps in series, operated off 600-volt railway bus bars, to a straight 6.6-amperes series alternating current system. The new system, which it is expected will be entirely changed over and completed in April, 1920, will consist of the following installation: 59 1000-cp., 268 600-cp., 493 400-cp. and 128 100-cp. lamps.

The company likewise expects this year to run another No. 0 three-phase, four-wire feeder from the power station for the purpose of handling the load of the new LaFayette Hotel, this feeder line to have an installation of three single-phase feeder regulators in the power station. In addition duplicate feeders are contemplated to be run into the Maxwell street plant of the Lexing-

ton Ice Co., a subsidiary concern, which is changing over from a steam-operated to an electric-driven raw-water plant.

North Carolina Public Service Co. to Build Ten Miles of Power Lines.

Approximately 10 miles of electric light and power lines will be built by the North Carolina Public Service Co., Greensboro, N. C., during this year, according to plans already formed. In addition the company will install about 100 ornamental iron lighting and trolley poles on the main streets. The company will also double-track about five blocks and relay and repave about 10 blocks of the street railway line.

Georgetown Will Install Municipal New Electric Distribution System.

The city of Georgetown, Ky., has voted $100,000 in bonds and will install and operate a new electric distribution system of approximately 18 miles of pole line and wires for commercial light and power service, line transformers and equipment, service meters, switchboard panels, constant current transformers and street-lighting circuit for 250 street lights of 600, 400 and 100-cp. Mazda C lamps. The city will also operate about 60 boulevard lighting standards, equipped with 600-cp. Mazda C lamps. In addition to the lighting work the city will install a new waterworks system of 10 miles of 12-in. to 6-in. pipe, 120 fire hydrants, gate valves, meter-service pipes, a fire pump of 1200-g.p.m. capacity, two motor-driven centrifugal pumps 500-g.p.m. capacity, each against 125-ft. head, one water tower and tank of 150,000-gal. capacity, 125 ft. high. W. H. Weiss, city hall, Georgetown, Ky., is consulting engineer.

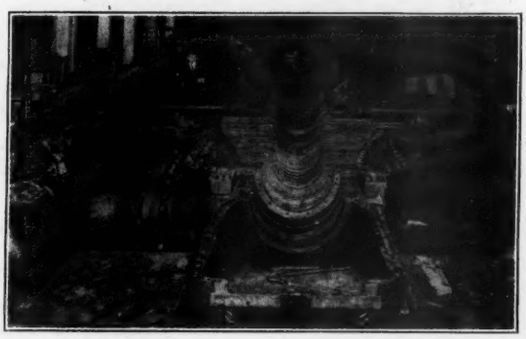
Many Improvements Planned by Cumberland County Power & Light Co.

Many substantial improvements are planned during the coming year by the Cumberland County Power & Light Co., Portland, Me., including a new hydroelectric station, cable lines and transformers. The company is now engaged in building a hydroelectric station on the Saco river at Bar Mills, Me., the present installation to be 2000-kv-a. capacity. This initial development will use one-half the flow of the river. The generating voltage will be 2300, will be stepped up to 38,000 volts and transmitted a distance of about 2.2 miles, and there connected with the main transmission line of the system. At the junction of the two transmission lines there will be installed horn-gap switches to be used for sectionalizing purposes.

During 1919 the company installed at the

Detroit Edison Co. Makes Record in Generator Installation

What is believed to be a record in turbine erection was made by the Detroit Edison Co. and the General Electric Co. in the installation of a new



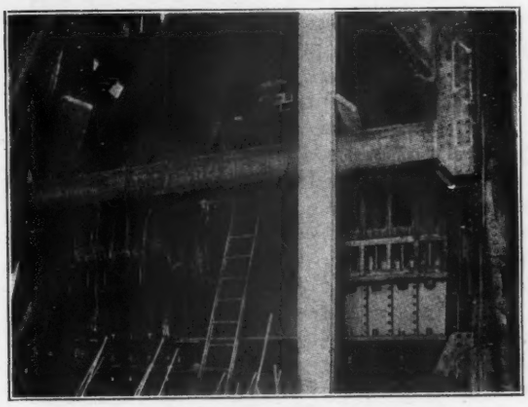
Lower Half of Turbine Casing, Showing Diaphragms Between Stages, Installed at Detroit Edison Co. Delray Plant.

30,000-kw. turbogenerator at the Delray plant of the Detroit Edison Co., when the machine was put in operation on Jan. 31, last, just 37 days after the first of the new equipment had reached the plant from the company.

The new equipment is a General Electric Curtis type turbine, having 14 stages and develops a little over 40,000-hp. when fully loaded. The machine takes 350,000 lbs. of steam per hour at 200 lbs. and 200 deg. F. superheat and the generator has a capacity of 30,000-kw. with a voltage of 12,200. The generator is connected solidly to a three-phase water-cooled transformer which stands almost directly beneath the machine and with not even a disconnect switch between the generator and transformer.

The turbine exhausts to a two-pass surface condenser containing over 25 miles of 1-in. brass tubing, or about 40,000 sq. ft. of condensing surface. Two condensate pumps with 50-hp. motors are installed to return the condensed steam to the heaters, one pump being a spare. Two circulating water pumps, each driven by 300-hp. variable-speed motors are provided, one being required in winter, while two will be used in summer months. These pumps have a capacity of 30,000 gals. per minute each and handle 43,000,000 gals. per day.

The turbogenerator is carried on a unique foundation built of structural steel and capped by a concrete slab about 30-in. thick, the whole being free from the building superstructure. The condenser, weighing 225 tons filled with water, is also carried on this steel foundation. To provide for the expansion and contraction of the metal in the turbine and condenser, the latter is carried on 40 short spiral springs, supported on cross beams in the steel



West Side of Condenser, Showing New Type of Supporting Springs and Steel Foundation at Delray Plant.

framing. This is the second foundation of this type built by the Detroit Edison Co., the previous one built at the Connors Creek power house, having proved entirely satisfactory.

Bonny Eagle station on the Saco river a new horizontal twin runner in one of the old waterwheel casings, the idea being to improve the efficiency of the station. Before doing any work the old wheel was tested by means of the salt-solution method and its maximum efficiency found to be about 75%. After the new wheel was installed it was tested by the same method and the maximum efficiency was found to be 88%. Having secured such favorable results with the first installation, it is the company's purpose to install this year two additional units similar to the one installed last year.

At the West Buxton plant, two miles below the Bonny Eagle plant, the company will install a 1500-kv-a. unit. This unit will be placed on the space now occupied by two waterwheel-driven exciters, the exciters to be so changed that each will be driven by one of the present units.

In Portland the company contemplates installing additional 11,000-volt cable capacity between two of its substations, thereby releasing for distribution purposes the present 2300-volt tie lines between the Sewall street and Plum street stations. This will mean the installation of additional transformer capacity at both these stations. At the Plum street station a new switchboard to replace part of one already in place will be constructed. To assure better service 15 new voltage regulators will be placed in three of the Portland substations and approximately 4.7 miles of new transmission line will be constructed to increase capacity between Portland and Biddeford.

In the railway department the company plans to rebuild about 2.5 miles of track in Portland and vicinity, as well as renew about 2.2 miles of 50-lb. T-rail on the Yarmouth division with 80-lb. rail.

Oil Belt Power Co. to Build Big Plant to Supply Texas Oil Fields.

An electric power station is to be constructed at Eastland, Tex., at a cost of approximately $2,000,000, including the expenditure that will be made in building a system of transmission lines to oil fields, towns and industrial plants within a radius of 50 miles. The Oil Belt Power Co. has been organized for the purpose of carrying out the project. It has purchased a site for the proposed plant and is assembling material for its construction. The primary purpose of the company is to furnish electrical energy for drilling and pumping oil wells, but it also plans to provide energy for towns and industrial plants of various kinds.

The State Board of Water Engineers recently granted the company authority to construct a dam across the Leon river near Eastland. This dam will be of reinforced concrete construction 25 ft. high and 600 ft. long, forming a reservoir that will occupy an area of 125 acres and impound 1600-acre-feet of water, which is equivalent to 55,000,000 gals. This supply is needed for the operation of the boilers and for cooling purposes in connection with the steam condensers with which the plant will be equipped.

The power-plant building will be of steel and concrete construction, 90 ft. square and 60 ft. high. Modern machinery will be installed, including two 3000-kw. steam turbines and necessary boilers. This will give the plant a capacity of 8000 hp. Power transmission lines covering the oil fields in this district will carry energy at 12,000 volts and 60,000 volts. Four miles of spur track will be laid to transport material to and from the site of the new plant. Power lines from the new plant will extend as far as Dublin.

The J. E. Lewis Syndicate of Eastland, which has acquired the Breckenridge, Eastland, Ranger, De Leon and Gorman electric light and power plants, has recently completed a high-tension line from Gorman to Dublin. From Gorman this line will be built into the high-tension lines the J. E. Lewis Syndicate has strung from Eastland to Ranger. Extensions to Rising Star, Cisco and other western points are contemplated.

It is stated that within the next twelve months oil field operators in Eastland, Stephens and adjacent counties will be furnished electrical energy for drilling, pumping and other purposes by the Oil Belt Power Co.

Oklahoma Gas & Electric Co. Is Building Extensive Transmission Lines.

Transmission lines to connect up its various utility properties and for extending service throughout the oil fields is the principal construction activity planned by the Oklahoma Gas & Electric Co., Oklahoma City, Okla., during 1920. The company is now building a system of 63,000 and 13,000-volt lines for this purpose.

Other new construction work of importance contemplated in Oklahoma is the building of a new power station at a point on the Arkansas river, near the town of Jenks. This plant, which will operate in conjunction with the present plants of the company at Drumright, Sapulpa and Muskogee, will contain for the present a 7500-kw. General Electric turbine unit and three 1165-hp. Babcock & Wilcox boilers, equipped with Westinghouse underfeed stokers. The turbine will be provided with Worthington surface-condensing equipment, and condensing water will be taken from the Arkansas river.

The plant will be arranged to distribute 13,000 volts throughout the surrounding oil fields, and will likewise be provided with transformers stepping up to 63,000 volts for connection with the present 63,000-volt lines operated by the company.

Arkansas Valley Railway, Light & Power Co. to Build New Power House.

One of the greatest building improvements to take place in Pueblo, Col., this year is the erection of a new power plant by the Arkansas Valley Railroad, Light & Power Co. The improvement, to cost at least $1,000,000, is brought about by the increased demand for electrical energy for power and lighting not only by the industrial plants in Pueblo but by the industrial plants and private enterprises and homes in the Arkansas valley from Pueblo to La Junta and from Pueblo to Sugar City.

The proposed power station will be an entirely fireproof structure of brick, concrete and steel construction and will comprise three sections.

The boiler room will be 40 ft. wide, 85 ft. long and 58 ft. high. The turbine room will be 54 ft. wide, 85 ft. long and 47 ft. high.

Pacific Gas & Electric Co. Places New Tower Line in Service

The extension of the Wise tower line from Mission San Jose to the Newark substation has been completed by the Pacific Gas & Electric Co. and the entire line from Halsey power house to the

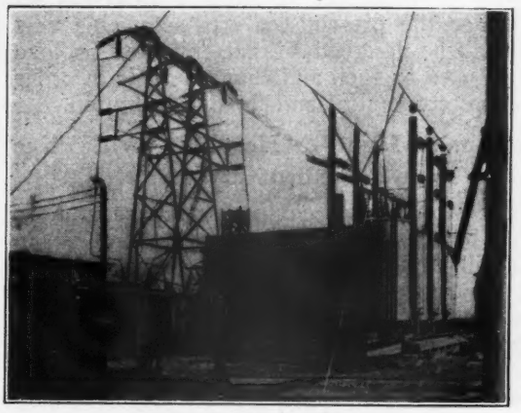
Newark Substation, Showing Temporary Oil Switches, Transformers, Switch Towers and Substation Building.

Newark substation was placed in service at 110,000 volts in January. Putting the line in service marks the completion of a project the company has been engaged on since 1916.

During 1920 a second circuit will be added to the Wise line from Drum power house to the Newark substation, via Halsey and Wise power houses, a distance of 161.5 miles. The operation of the Wise line at 110,000 volts and the addition of the second circuit will afford greatly increased transmission capacity from the Drum, Spaulding, Alba, Dear Creek, Halsey, Wise, and Colgate hydroelectric plants in Placer, Nevada, and Yuba counties to the south San Francisco bay district, whose rapidly increasing demands for electric power had overtaxed previously existing facilities.

The removal of the company's switching center to the Newark substation required the extension of the 60,000-volt Electra line to the substation. The operation of the Wise tower line at 110,000 volts made necessary the installation of equipment for transforming from 110,000 to 60,000 volts, as the Oakland, Electra and the two San Francisco lines operate at the lower voltage. The transformers are 12,000-kv-a. capacity each, making a total of 72,000-kv-a. for the two banks to be installed. Each transformer is by far the largest used by the Pacific company and the substation as a whole will have twice the capacity of any existing station on the system.

The rapidly growing demands for electric service of southwest Alameda county, together with the removal of the present Mission-Oakland line and the substations at Mission, Niles, and Decoto, made necessary the development of a new scheme for the supply of this district. It was determined to have the Newark substation serve this territory at 11,000 volts and the main transformers were therefore provided with additional windings for supplying that voltage. A part of the new plan of distribution consists in the construction of an 11,000



View of 100,000-Volt Switch Tower at Newark Substation of Pacific Gas & Electric Co., During Construction.

to 4000-volt substation at Centerville of 1500-kw. capacity and provided with automatic voltage regulators. Some 25 miles of new 11,000-volt line are under construction to distribute the power from the new substation.

The plant will be equipped with a 10,000-hp. turbogenerating unit provided with surface condensing equipment and the necessary auxiliaries of the most modern type.

Steam will be supplied by three high-pressure, water-tube boilers, provided with automatic underfeed stokers and connected to a self-supporting steel stack 250 ft. high. Adequate coal storage facilities will be provided and the plant will be equipped with the necessary modern machinery for the handling of coal and ashes.

The galleries will be equipped with switchboard, switching equipment and controlling devices for the operation of the turbine and electrical auxiliaries and for the control of the local circuits and outgoing transmission lines.

The plant is expected to be in operation by next winter. While the erection of a new power plant is probably the greatest improvement to be made by the company in the coming year, it will be necessary also to increase the capacity of the company's transmission lines and substations in the Arkansas valley in order to care for the increased service demanded.

The entire high-tension system from Pueblo east will be enlarged and reinforced by the installation of an additional substation, and tie lines connecting the various transmission lines will be added, thus doubling the present capacity of the available service now in the valley.

Pacific Gas & Electric Co. to String New Transmission Circuits.

The Pacific Gas & Electric Co. has approved plans for stringing a second circuit of No. 000 copper wire on the Wise 100,000-volt tower line from Drum power house to the Newark substation, a distance of 165 miles. Work has just started on stringing a second circuit of No. 000 copper wire on the Port Marion-Salinas 60,000-volt line. This line is 75 miles long and is part of the properties of the Sierra and San Francisco Power Co. recently leased by the Pacific Gas & Electric Co. for a period of 15 years.

Bartlesville Gas & Electric Co. Plans to Install Turbine Unit.

The installation of a new 1500-kw. Westinghouse turbine in its power plant is the principal new work to be undertaken by the Bartlesville

(Okla.) Gas & Electric Co., this year. This work is now under way and will be completed in the early spring. The company is also building an extension to its distribution system which will be completed by next fall.

York County Power Co. Will Build Substation and New Transmissionn Line.

In order to enable the company to give better service the York County Power Co., with headquarters at Portland, Me., has purchased nine voltage regulators. New and larger transformers to serve the Old Orchard section have also been purchased. A new substation will be built at Biddeford Pool, together with a new transmission line connecting the substation with the present system. The object of building the new substation is to locate it near to the center of the territory it serves. In the gas department the company contemplates installing a water-gas set to replace the present coal-gas set. This new plant will be designed so that either oil or coke may be used as fuel, and changes made in order to secure economical and flexible operation.

Indianapolis Light & Heat Co. Will Place New Equipment in Service.

Among other new equipment to be put in service by the Indianapolis Light & Heat Co. in 1920 will be an 18,500-kv-a. Curtis turbine and generator, 4000 hp. in Stirling boiler capacity operated at 250 lbs. pressure, Babcock and Wilcox superheaters for the boilers to provide 200 degrees superheat, Riley under-feed stokers, three 1500-kv-a. motor-generator sets and coal-handling apparatus. All of the above new equipment has already been purchased by the company.

Metropolitan Edison Co. Installing Turbine and Boilers at Reading Plant.

Orders have already been placed and the work is now being laid out by the Metropolitan Edison Co., Reading, Pa., for the installation of a 25,000-kw. Westinghouse turbine together with 4000-hp. in Edgemoor boilers.

New Bedford Gas & Edison Light Co. Now Building Engine-Room Addition.

The rapidly increasing power load of the New Bedford (Mass.) Gas & Edison Light Co. means much new construction work for the company during 1920. Work has already been started on an addition to the turbine room, about 60 by 95 ft., in which a 20,000-kw. turbine will be installed. The company is also building an addition to its boiler room, about 80 by 90 ft., in which eight 755-hp. boilers will be placed. The company will also build and equip a 20,000-kw. substation together with two or three miles of conduit and cable construction. The additions to the plant will give the company a total of 72,000 kw. and 15,640 rated boiler hp.

Elmira Water, Light & Railroad Co. Makes Change in Its Extension Policy.

The Elmira (N. Y.) Water, Light & Railroad Co. has made a change in its policy regarding line extensions. During 1918 and 1919 the company made its consumers finance all service and line extensions, but the company is now doing this work without charge to the customer. The following extensions and improvements are planned by the company during 1920: Purchase and installation of a 6000-kw. turbine and auxiliaries, rebuilding of two stokers, erection of 22,000-volt transmission line from power house to Elmira Heights, and the rearranging of its distribution system and installation of additional feeder regulators.

City of New Bern Is Putting in Considerable New Lighting Equipment.

The Water and Light Department of the city of New Bern, N. C., reports that a steadily increasing load on the municipal light and power plant makes necessary the installation of new equipment. The department has placed an order with the Allis-Chalmers Co., for a 1250-kw. turbogenerator and condensing equipment, which will be placed in service as soon as delivered. The department is also building a new waterworks and have ordered from the Worthington Pump Co., centrifugal pumps that are to be electrically driven. These new units will enable the city to take care of new business in its light, power and water departments.

Southern Illinois Light & Power Co. to Make Changes at Mt. Vernon.

Extensive improvements to the Mt. Vernon (Ill.) plant of the Southern Illinois Light & Power Co., are planned for this year. At the present time the company is installing a new 300-kw. unit to take care of additional power business. The company is also connecting up the village of Woodlawn, Ill., to its transmission line and is wiring street lights and residences in the village. In addition to this work power lines are being run to two new factories in Mt. Vernon.

Minnesota Gas & Electric Co. Obtains Cash for Farm Line Extensions.

The Minnesota Gas & Electric Co., Albert Lea, Minn., has extensive plans for transmission line construction to serve a few small villages and to build lines for farm lighting. Due, however, to the limitations of the company in being able to market new securities, no additional investments that are not paid for by the villages and farms to be connected are being considered. During the past eight months the company has raised over $41,000 in cash bonuses from this source toward the construction of 45 miles of 6600-volt farm lines.

Turbine and Other Equipment Will Be Placed for the Wilkes-Barre Co.

The Wilkes-Barre Co., supplying light and power to Wilkes-Barre, Pa., and vicinity, has already planned new construction work for this year and has let contracts for the installation of a 600-kw. General Electric turbine and for two 600-hp. water-tube boilers and other auxiliary equipment, such as condensors, pumps, etc., to be used in connection with the new turbine at the company's No. 1 station. The company has also arranged with the Concrete Construction Co., of Chicago, for the erection of a concrete smokestack 200 ft. high, with an inside diameter of 13

ft. The company will also do a limited amount of new line construction work.

Will Install Complete New Street-Lighting Systems in Two Ohio Towns.

New construction work listed by the Alliance (O.) Gas & Power Co. consists of the installation of new systems of street lighting in Alliance and Sebring, O., and the rebuilding of the distribution system of the company in Sebring. No changes in power-plant operation or addition of new equipment are contemplated at this time.

Penn Central Light & Power Co. Installing New Equipment and Lines.

Considerable new work is planned by the Penn Central Light & Power Co., Altoona, Pa., and at the present time the company has under way the installation of an additional 10,000-kv-a. Westinghouse turbogenerator at its Williamsburg plant, along with the necessary auxiliaries, boilers, additional transformer capacity, etc. The company is also double-circuiting 45,000-volt transmission line between the Williamsburg power plant and the Altoona substation, the line being constructed of steel poles and steel crossarms. The Collinsville substation is also being remodeled and will be equipped with up-to-date switches, relay, lightning arresters, etc.

Many Improvements in Plants and Lines Are Contemplated in Various Sections.

Outside of the usual maintainance work of all companies, many installations of various kinds are planned by companies in all parts of the country. Among them is the changing of a 2200-volt distributing system to a 4000-volt one by the Northern States Power Co., Stillwater (Minn.) division, work on which will be commenced at once and finished by May 15. The Lycoming Edison Co., Williamsport, Pa., has about completed the installation of a large turbine. The municipal electric light station of Henderson, Ky., will install coal handling machinery in its boiler room.

New work contemplated by the Western Gas & Electric Co., Aurora, Ill., will consist of the installation at the Aurora plant of a turbogenerator of about 3000-kv-a. capacity, 1000-hp. boiler capacity and coal-handling machinery. Stearns Lighting & Power Co., Ludington, Mich., has installed a 1200-kw. General Electric unit to take care of prospective business. This company reports that many rural extensions previously held up are now being made and are being financed by the farmers. A 60,000-kw. power plant recently finished by the United Illuminating Co., Bridgeport, Conn., will take care of increased load and line extensions of that company for 1920.

The Chester Valley Electric Co., Coatesville, Pa., is putting a new fireproof roof on its power station to replace one recently damaged by fire and will make the usual extensions for service in the distribution system. The company will also push the sale of appliances and actively solicit new business along existing lines. Extension of a 13,200-volt line, one mile in length, to the plant of the Lukens Steel Co. plant will also be made, furnishing a duplicate line to the plant.

FELLOWSHIPS TO BE AWARDED BY SCANDINAVIAN COUNTRIES.

Twenty American Students Will Be Given Opportunities for Study and Research in Sweden, Norway and Denmark.

Twenty fellowships, similar to the Rhodes Scholarships, each with a stipend of at least $1000, and in some cases $1200, will be awarded in May to American students, men and women, for technological research in the universities of Sweden, Denmark and Norway. The number of fellowships has been doubled since last year so that five students will be sent to Norway and five to Denmark in addition to the ten to be appointed for Sweden. Appointments will be made for the study of chemistry, physics, hydroelectrical engineering, metallurgy, forestry, agricultural sciences, language and literature.

These twenty fellowships are one-half of a group of forty exchange fellowships between America and the Scandinavian countries, financed on the one side by twenty American individuals and corporations, and on the other side by twenty Scandinavians. Application papers with letters of recommendation must be filed at the office of the American-Scandinavian Foundation at 25 West 45th street, New York, before April 1. The selection of the fellows will be made by a jury of university professors and technical experts appointed by the foundation. Successful students will be notified about May 1 and are expected to sail from New York in early summer, so that they may have several weeks before the opening of the universities to travel about in the countries to which they are appointed and to become familiar with the language and life of the people.

CONTRACTOR-DEALERS ATTEND N. E. L. A. MEETING.

Boston District members of the Massachusetts State Association of Electrical Contractors and Dealers were guests, March 18, at the "Question Box Conference" held by the New England Section of the National Electric Light Association at the American House, Boston.

American Electrical Men Operate Plant in Far-Off Guatemala.

In the group above are shown American officers and engineers of the Empresa Electrica de Guatemala, a company controlled and operated by the Electric Bond & Share Co., New York City, in Guatemala City, Guatemala.

Financial Outlook in the Public Utility Field

Review of Conditions, with Comment on Attitude of the Market Toward Investment in Utilities—Development of Local Markets for Sale of Securities—Relation of Public to Welfare of Utilities

By CHESTER COREY

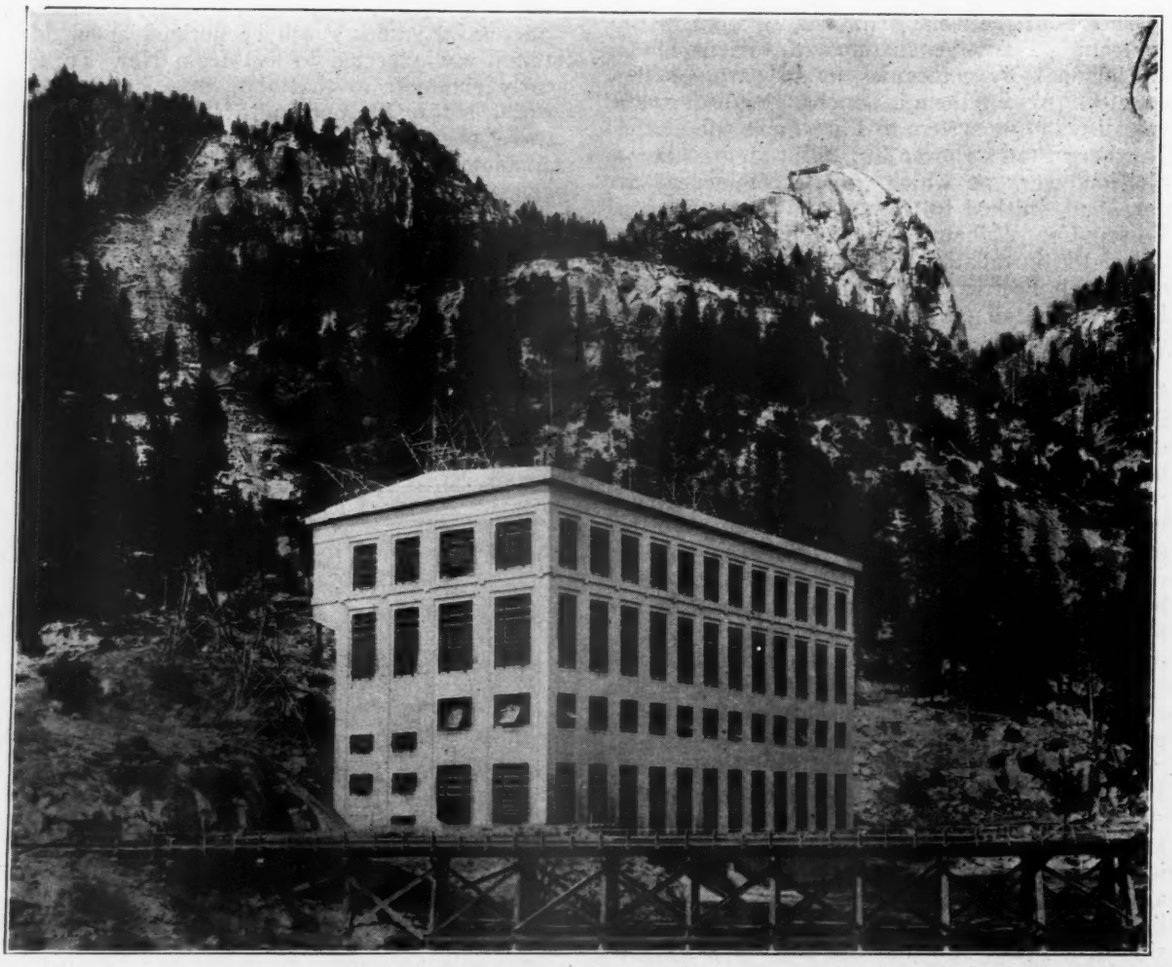
Vice-President, Harris Trust & Savings Bank, Chicago.

Demands for services are being made upon central-station companies that in many cases are stretching generating capacities to the full limits of safety and in all cases are creating financial problems which are difficult to solve. Money is scarce, rates of interest are high, the investment market is dull, and many investors are prejudiced against the securities of public utilities. Long-time bonds to pay from 6% to even 6½% are not in favor and in many cases the investor can be attracted, and then only to a limited extent, by securities maturing in from two to five years, to pay from 7% to 8%. Furthermore, there is no general market for the stocks of public utilities.

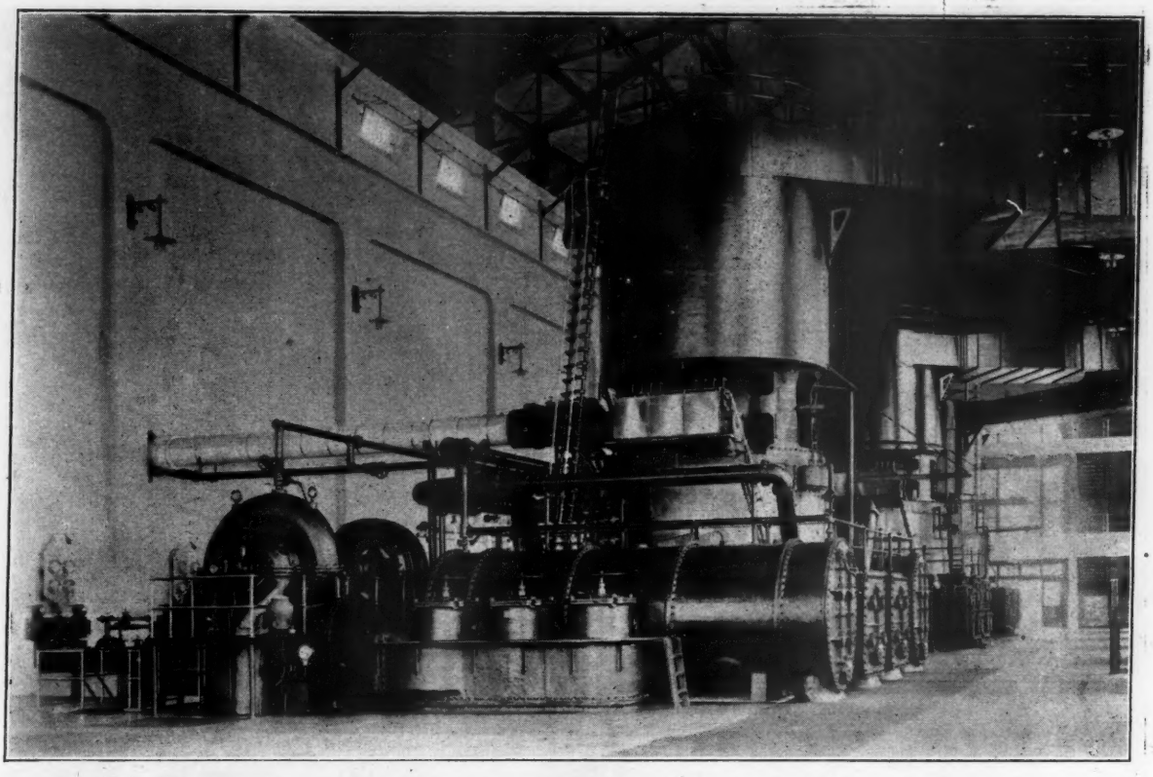
The prejudice of investors against public utilities arises primarily out of the misfortunes of the street railways and the failure of investors to realize that the electric light and power business has not suffered to any such extent as has that of the street railways.

Street-Railway Situation Influences the Market for Securities.

The troubles of the street railways began when the War Labor Board, without raising fares, raised wages, which in most cases probably needed to be raised. General operating expenses also increased, net incomes declined and in some cases reached the vanishing point. Defaults and re-



Big Creek Power House No. 1 of the Southern California Edison Co.—Capacity 32,000 Kw.—Operating Under Head of 2009 Ft.



Generating Room in Long Beach Power House of the South rn California Edison Co.

ceiverships followed and no wonder the investor in street railways became discouraged. The very seriousness of the trouble, however, has begun to bring relief. Rates of fare have been increased, free transfers have been abolished, paving charges have been remitted and various measures of relief have been afforded, but the credit of the street railways has not yet been restored and until this is done transportation facilities cannot be much improved.

On the other hand, while central-station companies have raised wages and all their operating costs have increased, labor is not such a large factor with them as it is with the street railways. Furthermore, rate increases have been more quickly obtained, so that while the rate of return upon capital invested in central-station companies has undoubtedly declined, the gross and net earnings of these companies have steadily increased.

Investment Bankers Not Stampeded by Conditions in Utility Field.

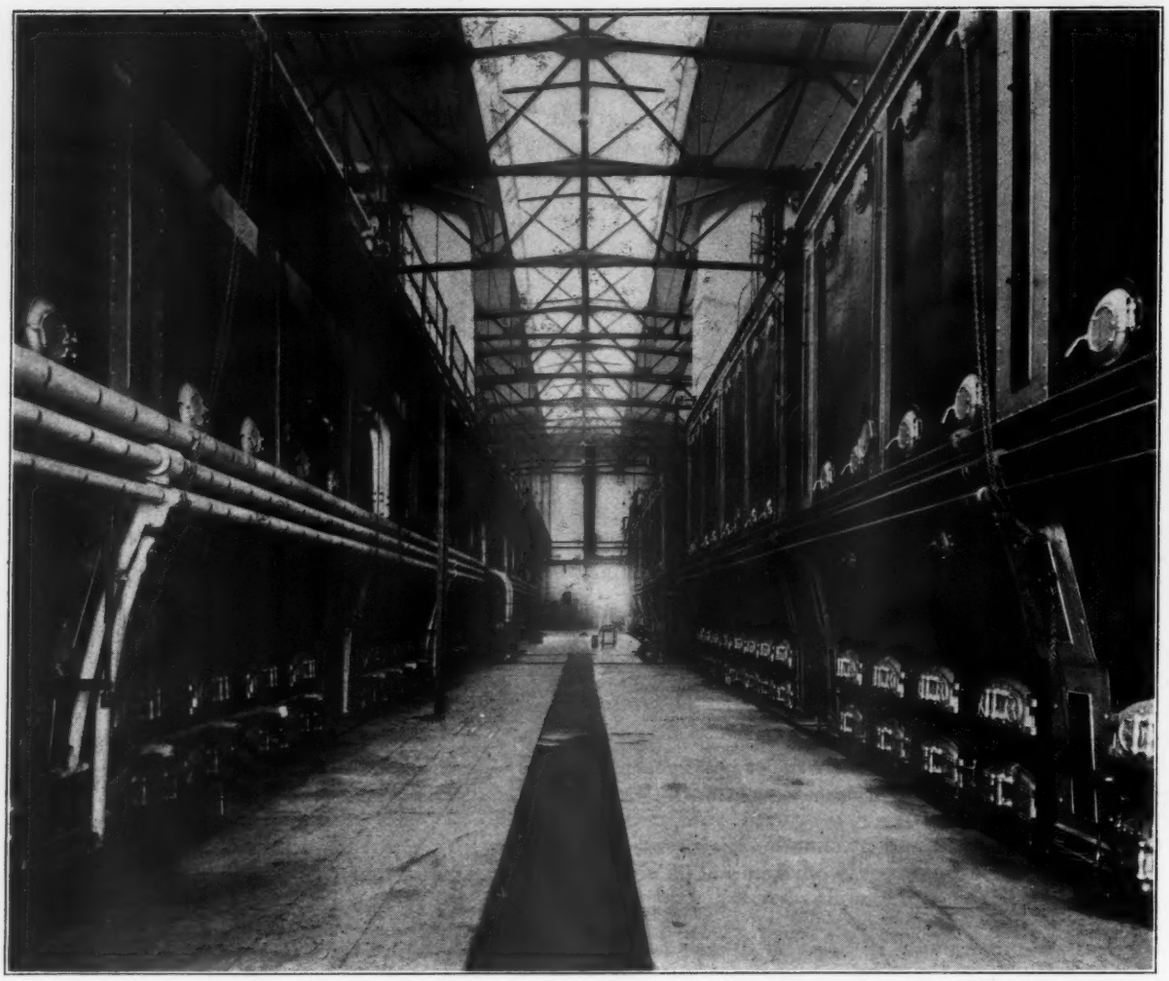
In spite of the prejudice of investors, the investment banker who understands the fundamentally sound position of conservatively capitalized public utilities has not been stampeded by the adverse developments of the last two or three years in the street railway situation and has furnished substantial sums of money to the public utilities. Like the public utilities, the investment banker is finding that his "cost of doing business" has largely increased, with the result that his margin of gross profit must be increased if he is to continue to function as the medium through which large sums of investment capital are to be made available for public and commercial enterprises.

The difficulty in securing new capital has led some companies to strain their borrowing facilities, with the result that these companies are now learning that it is poor financial policy for a public utility to borrow all of its capital requirements and if credit is to be maintained substantial sums from earnings and the sales of stock must be put back into the property. There has been the collapse of some unsound financial structures built by those who apparently tried to forget that funded debts and interest charges should always bear a conservative relation to the amounts of invested capital and net earnings.

Development of Local Markets for the Sale of Securities.

Notwithstanding the condition of the general investment market for the securities of public utilities, local markets are being developed for preferred and common stocks, and some of the larger electric companies are selling several million dollars' worth of stock a year to customers and employees. Were it not for such local sales of stock some of the companies would find themselves in a well nigh impossible situation, with insistent demands being made for extensions and no way to raise the money to pay for them.

Owners of public utilities must realize that substantial equities should be provided in order to keep funded debts from becoming dangerous and the investors must be educated to realize that when properly financed the securities of public utilities are conservative investments. While a great deal of helpful work has been done through magazines and newspaper publicity, the most effective educational work must be carried on by the public utilities themselves and by the investment bankers through their personal relations with their clients. The electric companies, if they have not already done it, should, wherever conditions permit, secure the direct personal interest of their employees and customers by giv-



Boiler Room in Long Beach Power House of the Southern California Edison Co.—Capacity 65,000 Hp.

ing them the opportunity to buy stock. The man who owns stock in a public utility becomes immediately interested in the problems of the company and if he is also a customer it becomes "his company." Rate increases, if they are necessary, are then understood and not frowned upon.

The public utility commissions are realizing more and more that the credit of the public utilities must be maintained, that in many ways the welfare of the communities is dependent upon the ability of the public utilities to develop their business, and that these factors are more important than the splitting of fractions on rates for service, "or rate of return," especially as high costs of operation and of money are matters of every-day knowledge.

Public Has Direct Interest in the Welfare of Utilities.

The general public still needs to learn that it has a direct interest in the welfare of public utilities. A "busted" company cannot properly take care of a growing community, and undue depreciation in the securities of public utilities hits the insurance company, the college endowment, the church and in many cases the widow and the orphan.

The immediate prospect is not a bright one and large amounts of new capital will not be available until the investor regains his confidence in the stability of the earnings of the public utilities, based on the willingness of the public to permit the utilities to earn a generous return upon the capital invested in the business.

If the money market eases up and the general investment market improves, individual companies will be able to take care of their minimum requirements, though naturally the companies with the best credit will be taken care of first.

For the present, anyway, construction budgets will have to be kept down to actual necessities, and in all cases should be kept within the amounts of money known to be available.

PITTSBURGH A. I. E. E. MEMBERS HEAR TRACTION DISCUSSION.

The March meeting of the Pittsburgh Section of the American Institute of Electrical Engineers, held at the William Penn Hotel, March 12, was devoted entirely to the subject of "Electric Traction." At the afternoon session papers on "Direct-Current Substation Protection" were read by W. M. Smith, of the Westinghouse Electric & Manufacturing Co. and J. J. Linebaugh, of the General Electric Co., and on "Automatic Substations," by R. J. Wensley of the Westinghouse company, and W. F. Peters, of the General Electric Co. At the evening session papers on "New Types of Chicago, Milwaukee & St. Paul Electric Locomotives" were read by N. W. Storer, of the Westinghouse company, and A. F. Batchelder and S. J. Dodd, of the General Electric Co.

Central-Station Service for Farm Light and Power

Effect of Electric Service on Farm Life—Demand for Transmitted Power—Financing Rural Extensions—Installation and Operation Data on Proper Voltages, Types of Systems and Substations

By H. W. YOUNG and F. C. VAN ETTEN
Delta-Star Electric Co., Chicago.

Extended investigation of farm-line possibilities indicates that there are two classes who will prove important factors in this growing field for central-station service. One is the country banker who provides means for depositing and checking out money and fails to search out methods for extending credit by virtue of which the farmer can purchase labor-saving equipment which will increase production. The other is the central-station company which is content to serve town customers, makes no effort to extend rural lines and gives but casual attention to the farmers' requests for electrical service.

Indifference to the farmer's needs is not good business, either from a local or national viewpoint. Farming must be profitable, productive and permanent for, if not, society in general will suffer. At this time, with the farm labor situation so acute, most farmers want central-station service to help perform the work which must be done. If the banker and the central-station company do not recognize this demand and provide the farmer with electric service, production will suffer. This means higher prices will be prevalent for farm products, which are the necessities of life.

Of these three—the farmer, banker and central-station company—the latter is the one who can best inaugurate a campaign for building farm lines, for the reason that it does or should know more about the problem than either of the other two.

After the requirements of a given township have been investigated, the cost of lines and equipment can easily be determined, and it is then only necessary to sell enough farmers the idea of central-station service to insure raising the necessary funds. This is not a difficult problem, as many farmers are already convinced, and the necessary money can be secured, either from the farmers or from the banker. Concerted effort in this direction will develop a tremendous field for the sale of electrical energy and appliances.

Electric Service to Make Farm Life Attractive.

There is another angle to electric service on the farm, and that is the making of farm life so attractive that the children and help will want to stay on and develop the farm. The more labor-saving machinery and city conveniences are introduced the easier it will be to keep farmers on the farms, where they are needed. According to estimates by Professor G. F. Warren of Cornell University, the abandonment of farm life in favor of city life by men and boys during the past year has left more than 24,000 habitable farm houses vacant in New York state alone.

This exodus from the farm has taken place despite the fact that farm wages will be approximately 14% higher this year than last. Electrical comforts or conveniences, in one form or another, to be obtained in cities, are largely responsible for people leaving their farm homes. When they can enjoy these same comforts in their rural homes there will be less reason for them to leave.

The leadership of this country, in world industry, depends largely upon the number of progressive farmers who take up and continue modern methods of agriculture. American farms of the future must be equipped with electrical devices if they are to retain the high standards of living we now enjoy. Modern farms will appeal to the brightest of our youth and insure that the direction of the farms will be in competent hands.

Demand for Farm Lines.

This problem of supplying light and power to rural consumers from transmission lines is rapidly emerging from the experimental stage; in fact, it may be said that it is just now graduating from this stage. Indications are that a large number of central-station companies intend to do extensive work in this field during 1920. This work is being undertaken voluntarily by the operating companies at the present time, but behind this effort is the feeling that if they do not do something the farmers will; that is, they will enforce their demands for service either through the state commissions or by means of legislation.

This demand on the part of the farmer is only a natural one. It has been fostered by the advent of the small individual plants, and the central-station interests are indebted to the manufacturers of such equipment for the pioneer work that they have done. But the individual plants have been on the market for a sufficient length of time and in general use in such numbers not only to arouse the rural public to the convenience of electrical power and lighting on the farm but also to prove the worth of such plants. There are numerous farms to which it will be impossible to extend transmission lines for a considerable time. These farms constitute the field of the individual plants and a large one it is. However, the points of superiority of

transmitted power over the individual plant have become of general knowledge among farmers and for this reason they are demanding central-station service.

The advantages claimed for transmitted power in comparison with the individual plant include less ultimate investment, unlimited supply of power, 24-hour service, use of standard 110-volt appliances, no attention required, no house or barn space required, no acid fumes, smoke, gas, dust or noise, and no oil or gasoline to explode or catch on fire.

Farmers are quick to appreciate these advantages and there is, therefore, tremendous possibilities for central-station companies in this field. Their problem, however, is to finance the installation of lines and to make their operation a success; that is, to provide lines and equipment at a moderate price and so operated that they will not interfere with the more important duty of rendering service to municipalities.

Financing Rural Extensions.

In the past many of the central-station companies have failed in reaching the farmer because they were laboring under the impression that this class of service must be furnished under conditions usually found in cities and small towns. They attempted to finance the entire proposition and assumed all risks when setting the rates. Experience has shown that those rates were usually set too low, with a consequent dissatisfaction with this class of service. Today, however, they realize that there is little in common in the matter of supplying electrical energy to the rural consumer and to the inhabitants of cities and small towns.

The established practice at present is to require the farmers to finance the installation of lines and the substation equipment. Risks are eliminated wherever possible and the rates are set high enough to cover the balance of the contingencies. Where possible, farmers are required to shoulder all risks, which is where they rightfully belong. Many central-station companies even advocate that repairs on the line and other maintenance work be charged directly to the farmers, thereby guaranteeing adequate income. The tendency is to meter on the high-tension side so as to eliminate the uncertainty of core losses and their effect on the rate schedule.

By so shouldering the responsibility on the farmer, this field becomes financially possible, the supply of light and power to farmers becomes attractive to the central-station companies and farmers are able to obtain what they desire.

Operating Features of Farm Lines.

Knowing, therefore, that under such conditions this class of business can be made a financial success, central-station companies give their attention to the installation and operation features in order that the lines may be a success from an operating standpoint.

Line Construction.

When the farmers pay for all equipment, the operating company is not required to adopt the cheapest line and substation construction. The tendency to do this in the past was a large factor in the failure of farm lines from an operating standpoint. The type of construction adopted, while not considered good enough for the more important trunk lines, is nevertheless very satisfactory for farm-line service. It is made substantial so as to reduce the chance of line failure, thereby decreasing service interruptions and the liability for injury to the public.

Primary Voltages.

For serving farm loads transmission voltages of 2300, 6600 and 13,200 have come into extensive use. Just as operating men have learned that they must charge sufficiently for this class of service, they have also learned that they must use the higher voltages for this work.

As would be expected, the first attempts in this field were to serve farm loads at 2300 volts by short extensions from city lines. Those that have made the greater efforts have learned that this voltage soon limited the extension of farm lines. The limit of 2300-volt service lies in the regulation of such lines rather than in the line loss. It is this feature that is often overlooked when determining upon the proper voltage.

The extension of farm lines naturally leads to the serving of small towns and it is really a question if 6600 volts is not too low. It now appears that the standard line voltage for rural service will be 13,200. This voltage presents no serious operating conditions and the transformer losses, while larger than with the lower voltages, yet are within reason.

Under the policy of requiring farmers to finance the installation lines and substation equipment, the voltage does not become a handicap to the central-station companies in the matter of extensions. Farmers will finance a 13,200-volt line as readily as they will finance a 2300-volt or 6600-volt line. However, if a 2300-volt or 6600-volt line is installed at first it is a very difficult if not an impossible task to get the farmer to assume the cost of the change to the higher voltages often found advisable or necessary.

The advisability of using the higher line voltages may be more forcibly brought to one's attention by the statement that there may be served with 6600 volts an area approximately nine times the size, and with 13,200 volts an area approximately thirty-six times the size of the area that can be served with 2300 volts.

Grounded Single-Phase Type of System.

This type of system has been used to a small extent, but generally in the case of small central-station companies which have attempted to finance all construction. It is not recommended, principally on account of its large interference with telephone lines, and its use should never be considered when the financial burden is to be borne by the farmer.

Metallic Single-Phase Systems.

This type of system is being used quite extensively, but its use should be limited to short lateral extensions.

Three-Phase Four-Wire Systems.

This type of system has not been used to any great extent, but its use has been contemplated. It is mentioned here in the effort to caution against its use. This system is coming into

prominence on the higher voltage lines of extended length where the charging current to ground becomes an important factor and where it becomes necessary to definitely establish the neutral point of the system. But for farm lines using the lower voltages for relatively short distances its use is not recommended.

Three-Wire Three-Phase Systems.

This type of system has been extensively used and undoubtedly is the most satisfactory one. A combination of this system for the main artery and metallic single-phase lines for short laterals is the logical system to use. This system gives less severe operating conditions for fuses, oil switches and lightning arresters, and has the advantage that it can be operated temporarily with one wire grounded. It, therefore, requires less tree trimming, which is quite a factor in extensive service to rural consumers.

Farmers' Substations.

Farmers' substations are perhaps more important than the line construction, voltage and type of system. As mentioned above, farm lines will be extended from town to town and the importance of continuous operation becomes more pronounced. It has been this factor which has often caused central-station companies to refuse service to farmers even though a line runs in front of a farmer's home. They have feared to take on this load because of the hazard of interference with the continuous operation of the line. With a substation properly designed this fear on the part of central-station companies is not warranted.

In the past when the central-station company attempted to finance the line and equipment and to serve at too low a rate this was an important matter. Now that the farmer finances the entire project it becomes possible for the central-station company to put in a type of equipment that will eliminate many of his past difficulties. Equipment which, while within reason as to cost to the farmer, will amply protect his lines and reduce service interruptions to a minimum, is to be desired.

Requirements of Farmers' Substations.

Following are some of the factors which determine the design of a farmer's substation, for it is this equipment that means much to the success of supplying electricity to the farm.

(1) It must be inexpensive. This does not mean that it must be cheap.

(2) While inexpensive it must perform all the functions of the larger outdoor substations with a reasonable factor of safety. It must have full switching, lightning protection and overload protecting features. It must operate with the same degree of security against service interruptions, but in case of failure it must be disconnected at once from the line in order that the trouble may be localized and prohibited from disturbing the entire system.

(3) It must be safe. There should be but very little wiring and it should be so arranged that when the switch is open all equipment is readily accessible.

(4) The factor of safety of the insulators should be high. Line disturbances due to switching and action of fuses or oil circuit-breakers usually manifest themselves at the switching equipment or at other points where the characteristics of the line change.

(5) It must be neat in appearance. This is a factor often lost sight of by central-station managers. These stations are often on the main highway or on the farmer's premises near his house. It must, therefore, not present a makeshift appearance.

USE OF ELECTRIC DRIVE IN ROCK-CRUSHING PLANTS.

Advantages of Individual Motors, with Data on Operating Costs with Electric Service as Compared with Steam Power Plant.

By Walter D. Myers,
Sales Engineer, Louisville Gas & Electric Co.

Unlike most lines of industry that can be and are established in convenient locations, accessible to all the advantages of labor, power, water and transportation facilities, stone quarries must, of necessity, be located where the deposits of stone are found, with the result that, with few exceptions, their locations are most inaccessible and remote from the advantages enjoyed by other lines of manufacture.

Due to this one reason more than any other the application of electricity has not been so general as in other lines of industry. The distributing power companies, in many instances, refusing to consider large investments in transmission lines and other equipment, the development of electricity in this field has practically been left to the salesmen of electrical machinery. Hence, the industry has been deprived, to a great extent, of the persistent efforts of the sales engineers of the central-station companies, who are the greatest developers of electricity in all of its uses. However, with this handicap, the substitution of electricity for steam power is increasing steadily in the stone quarries of the United States.

Electricity offers many advantages in works of this character. Almost every variety of stone-crushing machinery manufactured in this country is designed so that it can be driven by an electric motor. There are electric air channelers, electric hoists, electric locomotives, motor-driven air compressors, stone crushers, pulverizing mills, screens, pumps, electric-driven shovels or draglines; in fact, most devices used in connection with the quarrying of the stone and making it marketable can be driven with electricity.

Application of Motors to Rock-Crushing Machines.

We will deal only with a-c., polyphase service, as that is fast becoming the standard service not only furnished by the large power companies but recommended by all consulting engineers for plants of 50 kw. or more.

There are two general types of induction motors which fulfill the requirements of rock-crushing plants, *i. e.*, the slip-ring and the squirrel-cage types. The former, when furnished with drum-type, nonreversible controllers and resistance, is suitable for service requiring frequent starting under load, or the starting of loads with

high inertia. The squirrel-cage type motor, equipped with compensator, is extremely simple and able to stand hard service. The absence of a commutator enables it to operate satisfactorily in locations where dust and dirt would prevent the employment of slip-ring motors, but its construction does not enable this type of motor to be started with high torque; consequently, it is not adapted to certain loads, as for ball mills, tube mills, etc.

It must be recognized that it is impossible to establish definite ratings for motors to drive certain machinery, as the conditions under which machinery is operated will vary in different plants from 10 to 100%, causing a wide variation in power required. For general information, however, the accompanying table is used, as a rule, for recommending the size of motors for the different machines used in connection with rock-crushing plants:

Horsepower Required for Rock Crushers.

	Hp. required
Gyrator crusher—	
Size No. 1	6
Size No. 2	10
Size No. 3	15
Size No. 4	20
Size No. 5	26
Size No. 6	40
Size No. 7½	77
Size No. 8	100
Size No. 9	140
Size No. 10	175
Size No. 12	200
Size No. 18	250
Size No. 24	300
Blake crusher—	
Size, 4 by 10 in	4
Size, 7 by 10 in	7
Size, 9 by 15 in	12
Size, 10 by 20 in	20
Size, 15 by 24 in	25
Dodge crusher—	
Size, 4 by 6 in	4
Size, 7 by 9 in	8
Size, 8 by 12 in	12
Size, 10 by 16 in	18
Universal crusher—	
Size No. 1	2 to 3
Size No. 1-M	3 to 4
Size No. 2	5 to 8
Size No. 2-M	7 to 10
Size No. 3	7 to 10
Size No. 3-M	12 to 15
Size No. 4	15 to 20
Size No. 4-M	20 to 25
Size No. 5	25 to 30
Size No. 5-M	30 to 35
Symons disk crusher—	
Size, 24 in	18 to 25
Size, 36 in	30 to 40
Size, 48 in	50 to 65
Brainerd pulverizers—	
Size No. 0	8 to 12
Size No. 1	12 to 16
Size No. 2	20 to 25
Size No. 3	40 to 50
Griffin mill—	
Size, 42 in	50 to 60
Fuller mill—	
Size, 24 in	10
Size, 33 in	35
Size, 42 in	50
Size, 57 in	100

Prior to 1914 the cost of operating a power plant in most lines of industry did not receive very much consideration, but since that time coal, labor, machinery and other items entering into the power-plant costs have largely increased until it has grown to be a very important item in the yearly operating expenses. For this reason owners have begun to look upon the power plant with some consideration and are investigating the advisability of substituting other forms of power and, naturally, turn to the consulting engineers or large power companies for advice.

The electricity required in the operation of rock-crushing plants varies from 0.34 to 3.3 kw-hr. per ton of rock crushed. The wide variation in energy is mostly due to the character of the rock, the quantity of air required in drilling and whether the method of drive is individual or group.

Cost of Operation.

As an illustration, the following comparison is given between the cost of operating a typical stone-crushing plant with purchased power and operating the same plant from an individual steam plant. The plant in question employs 35 to 40 men, operating 10 hrs. per day, for crushing limestone for ballast. It operates from March 1 to Dec. 1 and is idle the remainder of the year. Its capacity is 600 to 700 tons per day, and the connected load is 345 hp. in individual drive motors.

Cost of Operation With Purchased Power.

Electrical energy, 126,000 kw-hr. per year at 3 cents per kw-hr	$3,780.00
Minimum charge for 3 months plant is idle	517.50
Yearly operating cost	$4,297.50

Cost of Operation with Steam Power.

756 tons of coal at $4 per ton	$3,020.00
Labor, fireman, $3.50 per day	945.00
Oil, waste, boiler compound and miscellaneous	150.00
Interest, 6%; depreciation, 7%; taxes, insurance and upkeep, 3%; or a total of 16% on $10,000 investment in boilers and building for power plant	1,600.00
Yearly operating cost	$5,715.00

The maximum prevailing rates usually quoted for service in such quantities have been used in these assumptions. The cost of steam engines is not included for the reason that the cost of motors for the electric-driven plant will just about offset the cost of engine units. The cost of an engineer is not included in the steam operated plant for the reason that the claim will be made (though not always true) that an electrician will be required in the electric-driven plant.

Aside from the actual saving of over $1400, or 25% per annum, as shown in operating cost, electric service has many advantages. It can be applied at the point where the power is needed it can be so distributed that no part of the plant is dependent on the other for operation. The plant may be started in operation by simply throwing a switch. The money invested in a power plant can be invested in producing machinery and earn many times the 6% allowed for interest charge.

WILL HOLD INDUSTRIAL FAIR AT HELSINGFORS, FINLAND.

It has been arranged to hold at Helsingfors, Finland, from June 27 to July 6 next an industries fair, which should give engineers and manufacturers a good opportunity of showing American products and manufactures. There is much undeveloped water power available in the country and many schemes are projected for erecting hydroelectric stations. Consequently there should be a demand for hydroelectric machinery, electric light fittings, electric motors, cables, etc. A list of the materials and manufactures required can be inspected at Finnish Legations and Consulates, and inquiries can be addressed Finska Messan, Helsingfors, Finland.

Pompton Lakes Hydroelectric Plant

Features of New Small-Capacity Hydroelectric Plant Which Has Reduced Operating Costs to a Low Figure

A population of 3000 is a rather inconspicuous figure in this country of large cities, yet when it comes to initiative, the town of Pompton Lakes, N. J., demands recognition. Proof of this claim may be found in the development of its municipal hydroelectric plant.

The former municipal power station was typical of a large number of plants established throughout the United States. Motive power for the two 50-kw. generators was provided by 75-hp. gas engines, and a daily consumption of from 2 to 3 tons of coal for the gas producers was essential. In addition to this, the staff expense was comparatively high, as it was necessary to employ a superintendent and four assistants.

With an increasing use of power, the authorities found that the old station would not be large enough to supply the demand and it was decided to build a new power plant on a more

View of New Hydroelectric Power Plant at Pompton Lakes, N. J.

generous scale, and also on a more economical basis, utilizing as motive power the overflow from Pompton Lakes. These lakes, which are fed by the Ramapo river, are comparatively close to the town.

A subscription was raised and the dam was purchased by the municipality. New headgates were installed and a flume, 100 ft. by 24 ft. by 10 ft., was built from the dam to the power station, the overflow approximately 125-hp. and 225-hp. capacity at a 21-ft. head. Woodward oil pressure governors 6 in. by 12 in. and 5 in. by 9 in. are used.

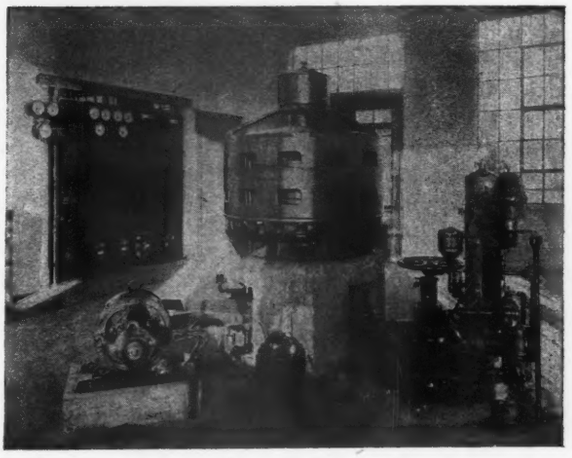
The turbines are direct-connected to vertical generators of 100-kv-a., 300-r.p.m. and 250-kv-a., 200-r.p.m. capacity, respectively, the combined weight of the waterwheel and generator rotors being carried by a Kingsbury thrust bearing supported by the upper guide-bearing bracket of the generator. As the peak load at present is only 85 kw., thes maller unit develops sufficient power to meet this demand, but both units are operated alternately. The exciters are belt-driven by one-quarter-turn belt and idler. The gener-

Dam and Spillway at Pompton Lakes Hydroelectric Plant.

ators operate at 2400 volts, 3-phase, 60-cycle, with 125-volt excitation. A balanced regulator furnishes current for street lighting at 2400 volts. The generators, exciters, street-lighting transformer and the five-panel switchboard controlling the entire equipment were built by the Westinghouse Electric & Manufacturing Co.

The building is a 30 by 60-ft., two-story brick structure, concrete floored and, with a general office, transformer room, generator room and a garage, affords more than ample space.

In addition to house lighting for the town, this plant furnishes electrical energy for approximately 30 miles of street and road lighting, oper-

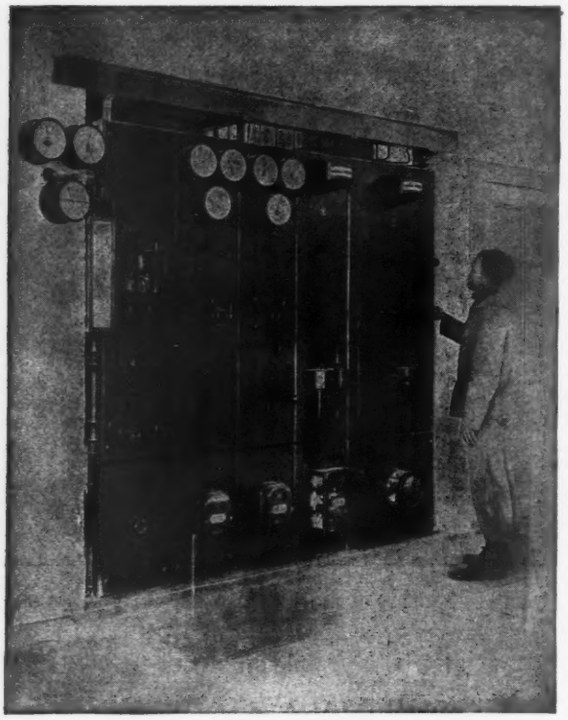


250-kv-a., 200-r.p.m. Generating Unit in Pompton Lakes Hydroelectric Plant.

ates the pumps that supply the local reservoir and is used by five factories and an electrified coal elevator. In the near future electric power

from this station will also be used by the towns of Riverdale, Pohmpton Plains, Haskill and Midvale.

The efficiency of this power plant is unusually good and it is stated that the net operating cost is only about one-third of that of the old station. J. A. Burrell, chief engineer, and two assistants



Five-Panel Switchboard for Controlling Generators and Distribution at Pompton Lakes Plant.

constitute the staff, as compared to the staff of five formerly required to operate the old station. With the prevailing coal situation, Pompton Lakes may be considered as being in an enviable position with regard to its power supply.

RAPID EXTENSION OF RURAL LINES PREDICTED.

Many Factors Contribute to Make the Present an Opportune Time for Extending Electric Service to Farmers.

That the time is ripe for the rapid extension of electric service into rural communities is the opinion of R. T. Calloway, of the Electrical Engineers Equipment Co., Chicago. In a recent statement regarding the present activities in that field, he said:

"There are a great many factors which tended to bring about this state of affairs. Farm life today is not what it was a decade ago. It has not stood still, but, on the contrary, has progressed in practically the same ratio as other forms of social and business life. The rural free mail delivery, the parcels post, the telephone, hard roads, the automobile, etc., have brought the farmer into frequent and intimate contact with city dwellers. He and his family are no longer people who live away in the country, coming to town each Saturday in a slow, cumbersome horse-drawn vehicle to market their produce. Instead they are in town almost every day in their automobiles, which make the trip, in most cases, a matter of minutes instead of hours. The farmer has come to know the many advantages which city dwellers enjoy and it is only a natural human desire to want them himself. The bountiful crops of the last few years has placed him in position to pay for them.

"In our own industry, the trend toward centralized generation of power and its transmission by high voltage to distant points has helped place the farmer in position to receive electric service. The transmission lines of the power companies are in most rural districts. It is almost impossible to ride for any distance upon a railroad train without encountering a high-tension line. As in the city, so in the country, the central station is the logical source of electric supply.

"The farmer is a large user of power. He will also consume light in larger quantities than the average city family. The market is there, the high-tension lines are there or close by, so manifestly the only thing left to do is arrange a means whereby the farmer either individually or collectively can be put in touch with the central-station company and the financial and construction details for the improvement worked out. This can be accomplished by the central-station company alone or by a contractor-dealer working with the central-station company. The manufacturers of electrical equipment stand ready to support the central-station companies and contractor-dealers in their campaign for business of this class. Already considerable propaganda has been spread regarding this new field of activity. It is our belief that those central-station solicitors and contractor-dealers who go to the farmers with this proposition in a clear, concise and attractive form will find them in an extremely receptive mood."

POWER DEMANDS INCREASING IN THE PACIFIC NORTHWEST.

In the Pacific Northwest the marked decline of the electric power load in shipbuilding is being compensated for to a great extent by the rapid increase of power demands in other lines of industry. The reduction in shipbuilding referred to, of course, is that which came everywhere with the cessation of war and with the completion of government contracts. Most of the yards are reaching out for contracts to build steel ships for private concerns, and the result is an adjustment of shop forces and motor loads to meet the demands of the industry on an after-war basis.

At Portland, Ore., the G. M. Standifer Corp. has in hand contracts to build five 25,000-ton steel cargo ships and three tankers, and the prospect is that its shops will continue in operation. In like manner several of the shipyard shops on Puget Sound have contracts that will keep them busy this year.

Among the industries at Portland which are expanding, as is evidenced by an increased electric power consumption, are those operating wood-working machinery to produce wooden sash, doors, mouldings and various types of finishing parts. Concerns engaged in this line of manufacture are busy on orders from many parts of the East and Middle West for both soft

and hardwood products. In those plants the motor drive is in evidence in nearly all cases, notwithstanding the fact that mill refuse is available for fuel in case steam drive was decided upon. In this there is demonstrated the superior adaptability of the electric drive for which central-station power is required.

The Aladdin Co., which is equipping a factory at Portland for the manufacture of ready-made houses, will require a motor load of 300 kw., and the new Portland Cereal Mills will soon be ready for a connected load of 600 kw., while the American Can Co.'s new plant in Portland for making fruit cans will use a motor load of between 300 and 400 kw. The Western Wax Paper Co., which has established a factory in Portland has already contracted for power with one of the central-station companies.

The Northwestern Electric Co. has recently extended 11,000-volt lines from its Albina substation in Portland to Kenton and St. Johns, two manufacturing suburbs, to supply power for factories and shops. The consumption of energy by electric ranges in Portland and vicinity is an increasing factor. The Portland Railway, Light & Power Co. has 450 ranges on its lines and the Northwestern Electric Co. has 375. The former company connected its lines with 300 new residences in November, 1919, and similiar work by the latter company indicates good building activities in spite of costs which, by comparison with those of five years ago, are considered excessive.

The Puget Sound Traction, Light & Power Co., whose lines extend over five counties of western Washington, is increasing its power load

Forty Years a Central-Station Man

Today 40,000,000,000 kw-hrs., in round numbers, is the yearly electrical output of the 8,000 or more central stations of the country. These figures emphasize the fact that the practical application of electricity has been by far the most revolutionizing factor in modern life and industry. In this rapid development the requirements of New York City have been among the most difficult to meet, and in the solution of the problems involved in supplying electric service to this vast community Frank W. Smith, vice-president and general manager of the United Electric Light & Power Co., has taken a leading part.

Frank W. Smith.

This year marks the beginning of the fortieth year of Mr. Smith's connection with the United Light & Power Co., New York City, and its predecessor, the United States Illuminating Co

Entering the electrical industry in his thirteenth year, he has been identified through the whole of his career with the organizations of which the United Electric Light & Power Co. is the outgrowth. From an office boy, Mr. Smith has risen to the position of vice-president and general manager of this company, which, distributing energy throughout the Borough of Manhattan, serves 40,000 customers.

Frank W. Smith was born June 22, 1867, at Alden, N. Y., the son of George Henry and Mary Matilda (Drake) Smith. Through both the paternal and maternal lines he comes of English stock, the families having been, however, long established in this country.

Coming to New York City at an early age, Mr. Smith received a public school education, and in 1880 entered the employ of the United States Illuminating Co. Promoted in 1883 to general clerk, he was made in 1889 paymaster of the succeeding organization, the United Electric Light & Power Co.

Two years later he was made assistant auditor, and eight years later assistant secretary of the company. In the following year he was elected secretary of the Brusch Electric Illuminating Co. of New York City, which office he has continued to hold since that time. In 1905 he was elected secretary of the United Electric Light & Power Co., of which corporation he is now vice-president and general manager. He is also a director of both of the last-named companies and of the Electrical Show Co. of New York City.

In his official capacity Mr. Smith was largely instrumental in bringing about the construction of the United Electric Light & Power Co.'s generating station at 201st street and Harlem river, as well as the 187th street substation. The generating plant, which, in its full equipment will represent an investment of $6,000,000, was placed in operation in 1914, and embodies many features of interest.

Mr. Smith has been closely identified for many years with the activities of the National Electric Light Association, of which he is treasurer, chairman of its Lamp Committee and a member of the Executive Committee. He is also a member of the Engineers' Club, the American Institute of Electrical Engineers, the New York Electrical Society, the Municipal Art Society, the American Museum of Safety and other organizations.

among the industrial plants of Seattle, Tacoma and other cities. There has been a marked increase of power demand at the coal mines in the foothills of the Cascade range, for haulage, screening and washing; the electric steel furnaces, which have become numerous, create a demand that formerly did not exist; a smelting plant for the reduction of iron ores for steel making, is expected to require a load of 1000 kw.; sawmills, wood-working plants, flouring mills, cement mills, harbor dredges, as well as hundreds of shops and factories, make a power demand on this system in the neighborhood of 145,000 hp.

In addition to the above that system, having a hydroelectric and steam-electric generating capacity of 166,600 hp., is now being drawn upon for 10,000 kw. for operating the west end of the newly electrified line of the Chicago, Milwaukee & St. Paul railway.

The municipal electric power system of Seattle, whose hydroelectric production is 10,000 kw., and steam-electric output 20,000 kw., had a power demand last August of 5000 kw. in excess of that of the previous year. While the ship-yard load on this system dropped off heavily, its load on other industries greatly increased, and in December, 1919, the power load was 2000 kw. greater than in December, 1918. New units, which have been ordered, will make possible an increase of 20,000 kw. at its two stations—the hydroelectric station at Cedar Falls, and steam-electric plant on Lake Union.

The 1919 sale of household appliances in the Puget Sound section of Washington, estimated generally, represented an increase of 100% over those of 1918; and farm lighting plants showed an increase, variously estimated at 50 to 100%. One of the greatest sources of increase in electrical supplies this year is in connection with building operations in Seattle and other Puget Sound cities. A feature of interest, often mentioned, is the demand for flood lighting on coal-mining premises, where 500 to 1000-watt units are required.

LAW OF SUPPLY AND DEMAND GOVERNS PRICES.

Necessary to Reduce Costs of Production and Teach People Thrift to Prepare for Economic Readjustment, Says Westinghouse Executive.

"The same economic forces that have sent prices up will also operate to bring them down," said Calvert Townley, president of the American Institute of Electrical Engineers, in a recent address before a meeting of the Schenectady Section of the Institute.

"Prices are up because wages are high. Wages are high because, due to the war, the demand for labor is greater than the supply. Much has been said about the existence of a 'new order' of things that will permit working men to demand hereafter a greater reward for their labor, but there is no indication of a new order in the facts. The working man is using today precisely the means to gain his ends that he has used for years, and that he is far more successful in gaining these ends than he has been before is simply due, to the present abnormal economic conditions and not to any revolutionary changes in human society.

"As long as America is called upon to supply a large share of the world's commerce, our factories will be kept busy, wages will stay high, and so will prices. But as soon as the European industry begins to function properly and the demands of commerce shall have again become normal, it seems reasonably certain that there will be an excess of production over consumption and some nations will lack a market. Translated, this means that the supply will be greater than the demand and wages and prices will fall.

"It is then that the test will come. If the United States shall have used its period of prosperity to prepare for depression by reducing costs of production and by teaching its people economy and thrift, the readjustment may come perhaps without any serious disturbances and we may save a good share of what we have gained by our running start.

"But if we sail serenely on, ignoring the possibility of a coming storm, if we continue the policy of working less and less and paying more and more while Europe buckles to, the resulting depression with its period of unemployment, suffering and possible panics is appalling to contemplate. Then prices and wages will come down suddenly and with a thump—such a thump as the country has never known. The inexorable law of supply and demand is no respecter of persons or of nations, and its deadly work will be deadly indeed.

"Men who have been trained to think straight and speak clearly must do what they can to show up the idiocy of dwelling in a fool's paradise. Dispel the bogey of class control. Brains have always ruled the world and always will. Show that we are dealing with a perfectly normal problem which must be solved in conformity to well-known natural laws and not with any mysterious unknown or novel principles, or with newly discovered rules of life. No organized minority created for the avowed purpose of taking from the majority some of its property or just rights can long prevail. Witness Germany's effort to subjugate the world. The law of supply and demand will ultimately just as surely bring down the cost of living and wages as it put these items up. The only uncertain features are the time when the changes are to occur and whether these costs and wages shall be brought down in an orderly and gradual manner or whether they shall come down amid disaster and distress."

EDISON CLUB OF CHICAGO TO HOLD "LIBERTY DAY" PARTY.

The Edison Club of the Commonwealth Edison Co., Chicago, has set April 6 as the date for a party to be held at Medinah Temple in honor of employes of the company who took part in the military or naval service of the United States in the world war. George W. Harris, vice-president of H. M. Byllesby & Co., Chicago, will be the speaker of the evening.

The members of the club are fostering the idea of making April 6 a national holiday in recognition of it as the day on which the United States entered the conflict.

EDITORIAL COMMENT

Pulverizing Coal in Central Stations

Pulverized coal has long been widely used for metallurgical and chemical purposes, but its use for steam raising has been very limited. Notwithstanding the vast possibilities that pulverized coal possesses, potentially at least, for steam production, progress has been much slower than one would have expected. This is probably in part due to the fact that such installations would have had to be made chiefly upon faith; and that was expensive. Another explanation is that drying, pulverizing, and conveying are complicated and expensive, and sufficient proof has been lacking of what could actually be done; while another possible reason is that power-plant engineers possess conservatism, and hesitate to adopt things new that are not of proven economy or reliability.

However, installations for pulverizing and burning coal have been made in steam power plants in isolated cases. Little has been given out as to what these plants are doing, or whether troubles, slight or insurmountable, are developing, what degree of reliability obtains and what sustained, week-by-week efficiency is to be expected. Under these circumstances the engineering world waits and watches and wonders.

The Milwaukee Electric Railway & Light Co adopted the use of pulverized coal at its Oneida Street station early in 1918 and has been operating practically continuously ever since. This company, now that it has had sufficient time to eliminate the little troubles that always crop up in any new station or with any new process or equipment, and maintain operation for many months, has removed restrictions as to visits to the station or the privacy of the results. In fact, it has very liberally encouraged visitors and has given out information as to the results obtained with pulverized coal as fuel.

Elsewhere in this issue appears a description of the installation at Milwaukee for burning pulverized coal, in which are taken up a few of the many interesting details developed by John Anderson, chief engineer of power plants, Milwaukee Electric Railway & Light Co.

With the promise of even higher coal prices and the gradual increasing scarcity of the more popular grades of coal, attention must be directed to the lower grades, the high-ash coals and the lignites. This means that pulverized coal should have a magnificent and unique opportunity to turn these inferior coals into a very useful product, which should preferably be burned at the mine instead of being transported.

The Milwaukee installation is the first large installation in which pulverized coal is used under steam boilers. The next largest installation is also promised for Milwaukee, the actual initial capacity being about ten times larger than the present installation. The use of pulverized coal seems to be on the way.

Future Development of the Industry

While a wide range of subjects will be discussed at the annual convention of the National Electric Light Association, to be held at Pasadena, Cal., May 18 to 21, inclusive, it seems probable that much of the discussion will relate to the future development of the industry not only from a central-station standpoint but from that of other interests in the industry.

New development plans and betterment to existing plants, to make up for the depreciation necessarily sustained during the world-war period, are now occupying the attention of most central-station companies and there undoubtedly will be a wide interchange of views on the subject at the convention.

A tentative program of papers to be discussed at Pasadena is given in this issue and a perusal of it will show that every phase of the electrical industry will be covered by the central-station men at their session.

One feature of the convention will be an exhibit of industrial and residential lighting in which novel effects developed during the past year, particularly in the use of color, will be shown. This exhibit will take the place of the usual showing of manufacturers' products.

Prices of Construction Materials

High prices have acted as a serious deterrent to the execution of countless construction projects for almost three years. The question is earnestly debated by quite a number of electric utility executives as to whether further postponement is the wisest policy to follow now. No universal answer can be given to this question. In nearly all cases the carrying out of the work will depend on whether the work is of such urgency as to off-

set the higher construction costs and fixed charges. In a great majority of cases new construction and rehabilitation of plants and lines has already been delayed beyond the point of expediency and far into the realm of necessity. We believe that further delay will be tolerated only where no means are available for financing the work on a reasonable basis.

Three important factors enter into this question. First is the necessity for new construction and improvements; second is securing capital for such construction, and third is the question of prices of materials and labor. These three factors practically balance one against the others. The question of prices of materials and labor weighs heavily in the consideration of the necessity of the work and securing capital to carry on such work. However, this much can be said: High prices should not interfere with the progress of the industry through the withholding of construction projects.

In these abnormal times one must necessarily hesitate to predict anything in regard to the trend of prices of material and labor. It is evident that prices will remain high until such time as production again becomes greater than consumption. It does not seem that this time will come for a year or so.

Reciprocal Relations Committee Has Field for Work

The Illuminating Engineering Society has taken a step in the right direction by the appointment of a Reciprocal Relations Committee which is working with the end in view of harmonizing relations between electrical societies and organizations and similar organizations in other branches of industry with which it is necessary for electrical manufacturers, central-station companies and contractor dealers to carry on business.

The committee plans a campaign of education in the use of proper lighting appliances so that architects and builders, particularly, will better understand the needs of the electrical trade in the design and construction of factory buildings and residences.

More attention must be paid to the education of the architect so that he will realize the importance of the installation of proper outlets, particularly in residences. With the multiplicity of type and design of residence electrical fixtures the supply and arrangement of proper outlets is an all-important one. Lack of proper outlets and of attention to proper design and use of fixtures is responsible for much of the poor effects obtained in residential lighting today.

With the proper outlets placed in new buildings it is only a matter of time when to a great extent the problem of standardization of fixtures and glassware will be solved. True there will always be a demand for a wide variety of fixtures and glassware, due to the personal desires and wishes of the householder, but with proper outlets the present haphazard method of installing fixtures will, to a large degree, be eliminated.

This standardization of fixtures and glassware is desired by all connected with the electrical industry and the Reciprocal Relations Committee in its work of education with other organizations can do much good in bringing to the attention of persons outside of the trade the fact that cooperation in designing and building work will aid all concerned.

Financing Electrical Construction

In connection with new construction and development work planned and already under way by electric light and power companies in all sections of the United States it is interesting to note that in many instances the necessary money needed to finance the different undertakings is being obtained by the sale of stock on the companies interested to customers and other investors in the local markets.

Public utility companies, both large and small, are taking this means of financing needed extensions to plants and lines and to obtain money for new developments. This policy, properly carried out, has a two-fold advantage for the company. It not only gives it the needed financial aid, at a time when it is hard to make use of public utility securities as collateral in the open money market, but it also enables a company to get in personal touch with the residents of the community in which it operates.

The sale of securities in the local market is a great advantage to a company, for it is apparent that a person owning stock of a public utility company, whether it be a lighting, power, traction or gas company, will take more interest in the welfare of the company than one who does not own stock. And public utility companies have come to realize in the past few years that friendly "boosters" on the outside are a splendid asset.

Many light and power companies serving farming districts are obtaining the necessary capital for the extension of farm lines by inducing the farmers to pay for the construction of the lines. In practically every instance the farmers, realizing that the public utility company cannot afford to extend the line for the amount of revenue to be derived from it, are willing to finance the necessary line extensions. In one Minnesota community a power company has received over $45,000 in eight months' time as bonus from farmers for extending its lines.

CURRENT EVENTS

Reports of Important Meetings, Developments and Other Happenings of the Electrical Industry and Its Allied Interests

LIGHTING CAMPAIGN OUTLINED IN PROSPECTUS.

Society for Electrical Development, Illumination Engineering Society and National Electric Light Association Join Hands in Campaign.

Plans for a campaign of education for better lighting and a "National Lighting Week," fathered by the Society for Electrical Development, in conjunction with the Illuminating Engineering Society and the National Electric Light Association, are taking concrete form and will soon be fully under way.

As one of the first steps to get central-station companies, contractor-dealers and manufacturing concerns interested a prospectus has been issued, giving an outline of what the campaign is to consist of and explaining the co-operation desired from the different electrical interests affected.

One of the first steps urged on the contractor-dealers and central-station companies is the obtaining of definite information covering the lighting needs of industrial plants in their communities. It is suggested that salesmen be instructed to do the work of obtaining names of persons in each plant on whom charge of the lighting arrangements falls, the names when compiled becoming available as a prospect list.

Probably the most comprehensive investigation of recent times as regards the role which artificial lighting plays in industrial processes was that conducted a few months ago by the Commonwealth Edison Co. of Chicago. The startling facts brought out by this investigation demonstrated conclusively that the beneficial effects of good lighting in facilitating and speeding up accurate production has been generally underestimated.

In one shop investigated in the Commonwealth Edison Co.'s tests an increase in production of from 8 to 27% was obtained when the lighting intensity was increased from 4 to 12-ft. candles. These figures covered eight different operations, which averaged 15% increases. An increase of 20% in production resulted from improved lighting in a shop finishing iron pulleys. In another test where the workers were assembling carburetors the efficiency was raised 12% through no other change than the improvement in the lighting. The number of rejections in the finishing department of a tannery was reduced 80% by the installation of a good lighting system.

In the prospectus facts and figures are given showing that the average lighting in industrial plants is poor, this information being based on the recent survey, when investigation of 446 plants showed that 69% of the plants thought they had effective lighting when as a fact the lighting arrangement was poor. Central-station companies and contractor-dealers are urged to sell good lighting, not merely equipment and it is pointed out that personal solicitation is one of the main factors in achieving this result.

In addition to furnishing information as to the scope and plan of the campaign the prospectus also contains sample letters to be sent out to prospects during the actual campaign, advertising copy that can be used to advantage by central-station companies and contractor-dealers, and illustrated data and tables gathered in a recent survey of industrial lighting conditions in the United States.

TENTATIVE PLANS ANNOUNCED FOR N. E. L. A. CONVENTION.

Outline Given of the Principal Reports and Addresses to Be Delivered at Pasadena Convention of National Electric Light Association.

Announcement has been made from the headquarters of the National Electric Light Association, 29 West 39th street, New York City, through George F. Oxley, director of the publicity department of the association, that a tentative program is being completed for the forty-third annual convention, to be held at Pasadena, Calif., May 18-21.

The program will be replete with points of interest for all affiliated with the electrical industry, prepared in such a manner that every phase of development during the last year will be covered. Prospective development during the coming year also will be considered, and ample time allowed for discussion of the papers and reports of committees to be presented.

Governor Stephens of California to Give Address of Welcome.

The address of welcome will be delivered by Governor William D. Stephens of California at the opening session of the convention, the morning following the reception given by President R. H. Ballard in the Hotel Huntington, which has been chartered outright for the convenience of the delegates and their guests and which will be headquarters for the convention.

President Ballard will respond on behalf of the association and will deliver his presidential address. He will be followed by M. H. Aylesworth, executive manager of the association, who will outline the reorganization of the association to date, what already has been accomplished under the reorganization, and the complete plans for the association during the coming year.

Following these addresses will come the presentation of reports and technical papers and their discussion. General sessions will be held mornings and special sectional sessions (in several instances necessarily paralleling each other)

will be held afternoons. The Public Policy Committee meeting will be held Thursday evening of convention week.

While the complete program has been arranged tentatively, it is not sufficiently complete in detail to be published in full at this time. Some of the "high-lights" of the program follow:

Franklin T. Griffith of the Portland (Ore.) Railway, Light & Power Co., will present the report of the Committee on Water Power Development, of which he is chairman. This subject is one of tremendous importance and interest in view of the evident present necessity for increasing the production of electrical energy sufficently to meet the existing and ever-growing surplus demand.

The subject of "Inductive Interference" will be dealt with in a report presented by A. E. Silver of the Electric Bond & Share Co., chairman of the Inductive Interference Committee. A complete summary of the present conditions and problems, and recommendations for association activities designed to further their amelioration and solution, are contained in the report and should precipitate a worth-while discussion.

"Electrification of Steam Railroads" will be considered in the report of a committee on that subject, presented by Frank M. Kerr, Montana Power Co., Butte, Mont., chairman. Improved practices and the outlook for the electrification of the steam roads of the country will be covered.

In the report of the Committee on Electrical Resources of the Nation, M. S. Sloan, of the Brooklyn Edison Co., Inc., chairman, startling facts are expected to be brought out. This is a "key subject," since the extent of future electrical development depends upon the electrical resources and their development.

The increasing cost of fuel for gasoline engines and the tremendous increase in the use of motor vehicles for the transportation of passengers and freight bring to an immediate issue the question of the development, manufacture and marketing of the electric vehicle. This issue and other phases of electric vehicle activities will be covered in an address by George B. Foster, Commonwealth Edison Co., Chicago, chairman of the Electric Vehicle Section of the association.

Motion pictures showing the electrification of manufacturing plants, shipyards and other industries will illustrate a paper on "Electric Machinery for All Handling," to be presented by Zenas W. Carter, secretary of the Material Handling Machine Manufacturers' Association.

Report of Committee on Public Information

Facts and figures on the value of proper publicity regarding activities and problems of the electrical industry in particular and of all public utilities in general will be given in the report of the association Committee on Public Information, of which John F. Gilchrist, Commonwealth Edison Co., Chicago, is chairman. Under the auspices of this committee and as the result of direct personal activity on the part of the chairman, state committees on public information have been organized by all public utilities, except steam railroads, in Illinois, Indiana, Kentucky, and are being organized in other states. The worth of the work done by these committees in making the public and regulatory bodies understand some of the problems of the utilities and the inseparability of the interests of the public and the public utilities will be made evident.

The importance of the fullest co-operation between all branches of the industry, for the mutual benefit of the public and of the industry, is given recognition by a place on the program in the form of a committee report to be presented by Lee H. Newman of the Pacific Gas & Electric Co., San Francisco.

Classification of accounts and the accounting relations between the National Electric Light Association and other organizations will be covered in a committee report presented by William Schmidt, Jr., Consolidated Gas, Electric Light & Power Co., Baltimore.

Lighting Exhibit to Be Feature.

Novel effects in residence and industrial lighting have been developed during the last year, particularly in the use of color. A demonstration of this development, the equipment used and its application will form an interesting side exhibit to the convention, and in a large measure will fill the vacancy left by the omission of the customary trade exhibit, which omission was made necessary because of the convention's distance from trade and manufacturing centers, the difficulty of securing prompt and adequate transportation, supply and demand conditions, and lack of suitable space for exhibition purposes.

Guests and members of the association who are particularly interested only in the four general sessions and in one or two of the eight sectional sessions will have the time for enjoyment of scenic trips, golf, tennis, bathing, boating, dancing and kindred amusements planned by Pacific Coast committees already perfecting details.

CLEVELAND ELECTRICAL SHOW ATTRACTS MANY VISITORS.

Sales at Ten-Day Exhibition Will Amount Close to $2,000,000 Is Estimate Made by Dealers.

The Cleveland Electrical Show, with 125 exhibits representing practically every electrical device of interest to the public and a great number to industrial heads, proved to be one of the largest and most successful exhibitions ever attempted in any locality by the electrical industry, according to statements from those in charge of the enterprise.

The show, which opened March 10 and closed March 20, had an average daily attendance of 20,000, despite the fact that the building employed—the Bolivar-Ninth building—was located nearly half a mile from the center of the city. The building was selected because of its size and adaptability to electrical devices. It has a total of 74,000 sq. ft. on two floors, the second of which can be reached by a sloping approach.

The total number of sales for the ten days of the show was estimated by heads of the enterprise at close to $2,000,000, including every actual contract sale and a very few so-called prospects of sales. In the latter class, however, only prospects who had actually announced intention of purchase were included and these numbered relatively small.

Men Prominent in Success of Cleveland Electrical Show

P. B. Zimmerman.

George S. Milner.

G. E. Miller.

The show itself was the result of three months of constant labor and much hustling on the part of some 200 members of the Cleveland Electrical League, who backed the enterprise.

These members were formed into thirteen committees, the heads of which formed an executive committee. The sub-committees were divided under the heads of finance, space, publicity, tickets, decorations, concessions, entertainment, program, etc.

Following numerous meetings of the smaller committees the executive committee would gather to compare notes and ideas. In this manner the greatest co-operation was obtained and when the doors of the show building were opened March 10 at noon, the machinery for its operation was so well oiled that there was not a single complaint received from any of the exhibitors or spectators.

Few people in northern Ohio were left ignorant of the fact that there was to be an electrical show in Cleveland. The publicity committee, armed with a budget of $10,000, literally plastered Cleveland and surrounding towns and suburbs with official posters of the show, with hangers and street car cards and special tack cards for posting in railroads and interurban stations.

A professional newspaper publicity concern was engaged to handle all the newspaper stories for six weeks in advance and during the ten days of the show for the entire state. This concern managed to publish three national stories in the newspapers, besides five separate two-column stories with pictures in newspapers throughout Ohio.

One of the national publicity features is a contest now being operated by 375 newspapers, representing the largest cities in the country, of interest to amateur wireless operators. The publicity man interested these newspapers to such an extent that they will award more than $1000 in prizes themselves. The Cleveland Electrical Show received the benefit of this contest, in that it was announced in the initial stories throughout the country that the contest emanated from the show.

Another feature which gained national fame was the installation of a wireless set at a prominent downtown corner which received news bulletins from various parts of the country. The story, which was broadcasted by the Associated Press to all its papers in the country, gave the show credit for being the first in the country to disseminate news by wireless.

Numerous other features of local interest brought crowds into the show. It will also interest dealers to know that these crowds were not of the usual food show or county fair type, but as individuals appeared as though any one of them could write out a check at the show for the purchase of almost any household article on exhibit.

One entire floor of the show was devoted to household goods and another to industrial and farm devices. The latter received far more interest than was expected, even among women who would be expected to confine their attention to the household section.

The show was in every respect a complete success, according to every one connected with it, and the electrical industry of Cleveland will undoubtedly receive man ylasting benefits through its medium.

Following are the members of the executive committee, who were chiefly responsible for the success of the show:

George S. Milner, general chairman and manager of the show; G. E. Miller, service; Harry Hutchisson, treasurer; S. C. Hansen, secretary; P. B. Zimmerman, publicity; Mathias Turner and N. H. Boynton, advisors; J. V. Becka, program; A. M. Collins, entertainment; J. A. Fitch, concessions; J. T. Kermode, decorations; H. S. Wahle, tickets; J. L. Wolf, space, and J. E. North, conventions.

"The Olympian," First Electrified Train to Cross the Cascade Mountains.

Chicago, Milwaukee & St. Paul Railway Completes Electrification of Pacific Coast Division

March 5 Marks Inauguration of Electric Train Service—Power Obtained from Hydroelectric Plants of Central-Station Companies in Washington

By W. A. SCOTT

In the issue of Jan. 4, 1919, there was published in Electrical Review an article descriptive of the electrification of the Pacafic Coast division of the Chicago, Milwaukee & St. Paul Railway in Washington, covering the subjects of line construction, substation equipment and electric locomotives. At that date the work was well advanced, and the essential facts concerning the features above mentioned were accurately set forth.

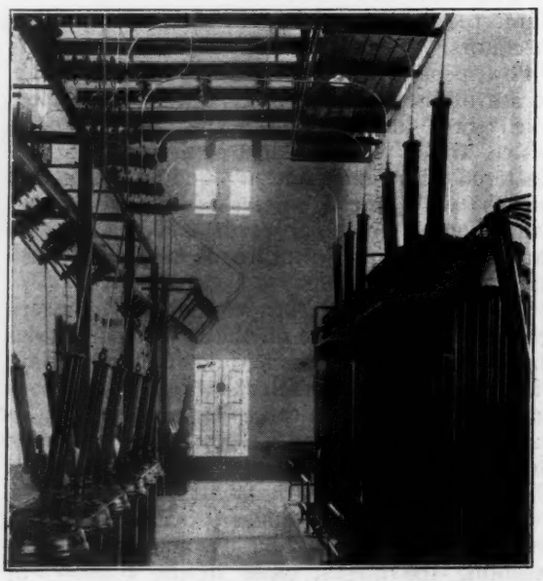
The entire electrification project is now completed in final detail, and electric trains are in operation on that division, extending from Seattle and Tacoma, on Puget Sound, to Othello on the east side of the Columbia river, a distance of 207.4 miles. This, added to the 440 miles of electrified railway that the company has in Montana, makes a total of 647.4 miles of line that derives its power from hydroelectric plants. Between the western terminus of the Montana electrified division and Othello is a stretch of 212 miles of road still served by steam locomotives. After that portion of the line shall have been electrified the Milwaukee company will have 860 miles of road over which passenger and freight trains will be electrically operated.

Electric Service Inaugurated March 5.

Electric train service on the Pacific Coast division was inaugurated March 5, when the "Olympian" train, the company's overland limited for Chicago, pulled out of Tacoma and Seattle, drawn by an electric locomotive, built specially for passenger service on that division. This locomotive is 76 ft. long and weighs 265 tons. It is equipped with 14 axles and 12 direct-current motors.

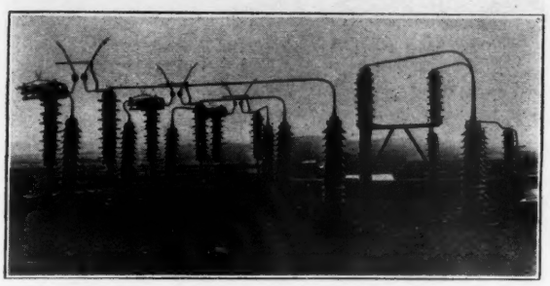
This was an epochal event that attracted the keen interest of railroad operators everywhere, and the movement of the heavy transcontinental train across the Cascade mountains was observed by over 100 members of an excursion party on a special electric train that preceded the regular train. The party was made up of railway and

Puget Sound Traction, Light & Power Co.'s Hydroelectric Station "Electron," on Puyallup River.



High-Tension Room at Kittitas Substation, Showing 25,000-Kv-a. Transformers and Breaker Equipment.

power company officials, heads of departments, representatives of electrical manufacturing companies, and many other invited guests, including members of the technical and daily press. The excursionists on this trip were the guests of



Lightning-Arrester Equipment on Roof of Kittitas Substation.

Puget Sound Traction, Light & Power Co., which, in co-ordination with the Washington Water Power Co., supplies electrical energy for the newly electrified division. Among those in the party were the following: Chicago, Milwaukee & St. Paul Railway—H. B. Earling, vice president; Macy Nicholson, general manager; R. Beeuwkes, chief electrical engineer, and F. B. Walker, superintendent of construction. Puget Sound Traction, Light & Power Co.—A. W. Leonard, president; W. J. Grambs, George E. Quinan, H. J. Gille and John Harisberger. Railroad men connected with other systems—W. H. Olin, of the Oregon & Washington Railway & Navigation Co.; R. Herzog and O. W. Bowen, of the Great Northern Railway Co., and L. B. Richards, superintendent of the Northern Pacific Railway Co. Representatives of electrical manufacturers—J. B. Cox, railway and traction engineering department, General Electric Co., accompanied by E. E. Kimball; H. E. Plank, district sales manager, Seattle; and A. W. Eshelby and W. D. McDonald of Westinghouse Electric & Manufacturing Co. Among other guests were R. B. Childs of the Intermountain Power Co., Butte, Mont.; Rene Martin of the Thomson-Houston Co.; W. A. Scott of ELECTRICAL REVIEW.

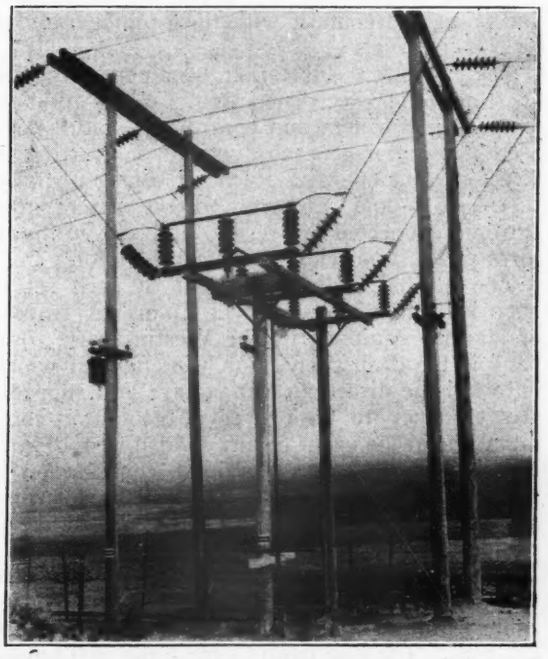
The summit of the Cascade range, at the crossing of this railway, is at an altitude of

One of the 42 Electric Locomotives on Pacific Coast Division.

2564 ft., and the Puget Sound terminal is practically at sea-level. The maximum grade over this mountain section is 1.7%, and the heaviest grade on the division is 2.2% this being between the Columbia river and Kittitas station. The even acceleration of speed between the valley and the foothills, and the steadily maintained speed over the heaviest grade to the summit, without jar or recoil, were among the interesting things observed by railroad and electrical men on this, the initial trip of the electric train referred to. It is asserted that the type of locomotive used here will pull a train of 12 loaded passenger coaches over this maximum grade at a maintained speed of 25 miles per hour.

POWER FROM HYDROELECTRIC PLANTS.

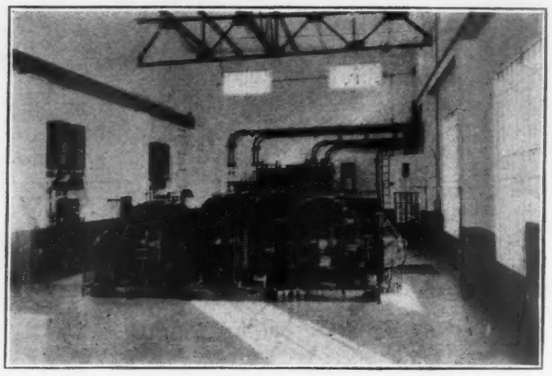
As previously stated, power for the operation of trains on this division is furnished by the Puget Sound Traction, Light & Power Co., and the Washington Water Power Co. The railroad transmission line connects directly with the former's hydroelectric plants on the Snoqualmie river, near Seattle, but those stations and the



Pole-Top Switch on Line Between Long Lake Hydroelectric Plant and Kittitas Substation.

two hydroelectric stations on the White and Puyallup rivers are all interconnected, and have a combined producing capacity of 114,533 hp. At the eastern end of the division, energy comes into the Taunton substation from the Washington Water Power Co.'s Long Lake hydroelectric station over a 170-mile transmission line.

Alternating-current energy is delivered to the railroad power lines at 100,000 volts. In the eight substations on the route between Othello and Tacoma this voltage is stepped down to 3000. The motor-generator sets in each substation, by which alternating current is converted to direct current, are attractive features of the equipment. The Cedar Falls substation, equipped by the General Electric Co., has two 2000-kw. motor-generator sets, each one consisting of two 1000-kw. 1500-volt generators, driven by one 2500-kv-a., 2300-volt, three-phase, 60-cycle, synchronous motor. The two generators are connected in series for 3000 volts, direct current, required on the trolley line.



Two 2000-Kw., 3000-Volt, Direct-Current Synchronous Motor-Generator Sets at Cedar Falls Substation.

Cedar Falls Substation, One of Eight Stations Supplying Energy on Pacific Coast Division

The 3000-volt, direct-current feeder lines run from station to station, having taps to the trolley line at 1000-ft. intervals. The return circuits of No. 0000 copper cable are strung on the feeder-line poles and connect with the running rails at 8000-ft. intervals.

The Taunton substation, equipped by the Westinghouse Electric & Mfg. Co., in addition to the transformers and control apparatus, contains two motor-generator sets for converting to direct-current energy. Each set consists of two 1000-kw., 6-pole, 1500-volt, direct-current generators, connected in series, and driven by a three-phase, 60-cycle, synchronous motor.

The normal, full-load output of each set is 2000 kw., 3000 volts, at 514 r.p.m. A feature of stations equipped by the Westinghouse company is the flash suppressor, the effect of which is to kill the direct-current voltage and suppress any tendency to flash over at generator commutators, in the event of any sudden rush of current beyond that for which the combination is set. The two substations thus briefly described are referred to as typical of the two kinds of equipment provided.

The railroad power line between Taunton and Cedar Falls consists of a 6-strand No. 00 copper cable with a hemp center, making one of 133,000 cir. mils. The line from Cedar Falls to Tacoma, via Snoqualmie Falls and Renton, contains 6 strands around a hemp center, of a cable diameter of 0.938 in. The Long Lake-Taunton transmission line consists of 7 No. 8 wires of a cable diameter of 0.3855 in.

Electric Locomotive Equipment.

The locomotives assigned to the Pacific coast division are of General Electric construction, each being equipped for car-heating and train lighting. The new locomotives built and recently delivered by the Westinghouse Electric & Manufacturing Co. are in passenger train service on the Montana electrified division, the original electric locomotives on that division having been assigned to the freight-train service.

It has been demonstrated, according to the testimony of those who have made a study of the economic phase of the problem, that electric motive power for railways may be maintained at approximately one-third the cost of that required in operating steam locomotives. It is announced that 42 electric locomotives on the Milwaukee divisions have replaced 112 steam locomotives, and that hydroelectric power on those divisions effects a saving of 300,000 tons of coal and 40,000,000 gallons of fuel oil per annum.

ELECTRICAL JOBBERS TO CHARTER SPECIAL TRAIN TO COAST.

The Transportation Committee of the Electrical Supply Jobbers' Association is arranging for a special train to leave Chicago on May 7 for Del Monte, Cal., where the twelfth annual convention of the association will be held May 12-14, the week preceding the annual convention of the National Electric Light Association at Pasadena, Cal.

The special train arrangement is in charge of Franklin Overbagh, general secretary of the Jobbers' Association, 411 South Clinton street, Chicago. It is planned to have members of the association from eastern cities assemble in Chicago and travel from there to California by the special train.

The party will travel by the Chicago & North Western, Union Pacific and Southern Pacific railways and will reach Del Monte 36 hours ahead of the opening of the convention. Arrangements for transportation, sleeping car facilities and hotels at Del Monte are being made by Mr. Overbagh, who requests all members intending to make the trip to get in communication with him at once.

A. I. E. E. TO GROUP MEMBERSHIP INTO GEOGRAPHICAL SECTIONS.

Board of Directors of American Institute of Electrical Engineers Recommends Adoption of Proposed Amendments to Constitution.

Ballots have recently been mailed to all members of the American Institute of Engineers from the office of Secretary F. L. Hutchinson, 33 West 39th street, New York City, to enable them to vote on proposed amendments to the constitution.

These amendments provide for carrying out the recommendations of the Committee on Development in its report of August 12, 1919, that the membership be grouped into geographical districts, that one vice-president be elected from each district and that vice-presidents hold office for a term of two years. Removal of the constitutional rule against the election of a vice-president as manager is recommended. Immediate re-election of a vice-president to the same

office is provided for, with provision against a greatly extended term of office.

It is provided in the amendments as proposed that all vacancies shall be filled by the board of directors in the case of unexpired terms, a vacancy in the office of president to be filled by one of the vice-presidents.

It is intended to transfer to the by-laws the details relating to seniority and changes and increases in the geographical districts. These have to date been governed by the constitution and their transfer to the by-laws would expedite the changes that will probably be made from time to time. A new section is proposed for adoption and reads as follows:

"At the election of vice-presidents held in 1921 there shall be elected one vice-president from each geographical district, those from the odd-numbered districts to serve for one year each and those from the even-numbered districts two years each. All vice-presidents elected thereafter shall serve for two years each. In the event of a change in the geographical districts, the vice-presidents shall complete their terms. In case of revisions of the geographical districts, the board of directors shall have the power to elect a vice-president from each district not represented, to serve until the next election covering these districts."

RESIDENTIAL LIGHTING DISCUSSED AT CHICAGO.

Results of Survey of Home-Lighting Conditions Given at Chicago Section Meeting of Illuminating Engineering Society.

At a meeting of the Chicago Section of Illuminating Engineering Society held in the rooms of the Western Society of Engineers March 17, the principle topic of discussion was residential lighting. W. A. Durgin, Commonwealth Edison Co., Chicago, presented a paper on "Fact vs. Theory in Home Lighting," in which he gave the results of a survey made during the past year of actual conditions prevailing in typical Chicago homes in regard to lighting.

In giving the results of the survey Mr. Durgin stated that his company had 320,000 residence customers who used electric service chiefly for lighting. A representative list of names totaling 5% of this number of customers was taken from the meter books of the company. Letters were sent to each of these customers and were followed by personal calls of the investigators. The customers were divided into four classes, depending on the type of dwelling, the rent paid and type of home being the governing factors.

The investigators obtained data on the size and areas of rooms, amount of daylight illumination, types of fixtures, number of lamps in use, the number of burned-out lamps and the number of empty sockets. Information was also obtained on the kind and number of appliances used in each residence, notations being made of the number, the wattage, their condition, and the size of the lamp removed when each appliance was used.

Data on the actual lighting conditions in about 750 homes were secured in this manner. The compilation of this data brought out some interesting facts. In living rooms it was found that portable lamps predominated, the percentages being from 48 to 55, depending upon the class of residence; pendant units ranged from 20 to 30% and a combination of pendant and portable units from 5 to 15%. In dining rooms pendant units ranged from 35 to 65%. In bedrooms the predominance of the single unit stem fixture was evident. The same held true for kitchens, and the data showed that 55 to 80% of the lamps were suspended vertically and 14 to 40% were at an angle, indicating combination gas and electric fixtures. The number of bare lamps in living rooms ranged from 22 to 28%, in dining rooms 7 to 45%, in bedrooms 10 to 15%, and in kitchens 40 to 70%. The watts per square foot in living rooms ranged from 0.5 to 1.8, in dining rooms 0.4 to 0.9, in bedrooms 0.3 to 0.8, and kitchens 0.4 to 0.5.

Mr. Durgin's paper was illustrated by means of lantern slides and also by an exhibit in which he showed typical types of lamps in homes commonly used in Chicago residences, and these brought out the evident need for improvements in residential lighting.

In the discussion J. R. Cravath pointed out that the trend in residential lighting was greatly influenced by those who sell the fixtures and that there was room for education in this direction. George Kader stated that architects should be approached first because they influenced to a great extent the kind of fixtures installed and the lighting effects obtained. Lee Farmer said that the architects obtain a great deal of their information from the fixture manufacturers and that the latter are anxious to co-operate in securing better results. S. M. Tideman said that the progress in industrial lighting should be paralleled with similar progress in residential lighting. Prof. Morgan Brooks of the University of Illinois brought out the desirability of irregular lighting to secure a cozy atmosphere in dwelling rooms. O. L. Johnson stated that the field was complicated, that the personal element enters largely into the choice of fixtures and the use of light, and that in many cases it was necessary to make the best of present lighting installations, arranging lamps, shades and fixtures so better results could be obtained. Among others who discussed the subject were Chairman F. H. Bernhard, Secretary E. D. Tillson and Messrs. Pike, Foster and Beall.

BI-STATE ELECTRICAL EXPOSITION TO BE HELD AT LOUISVILLE.

The Electrical Exposition of Kentucky and Indiana will be held in Louisville, Ky., Oct. 25-30, inclusive, and will be housed in the Jefferson County armory, one of the largest structures of its kind in the United States. The exposition will be held under the auspices of the Electric Club of Louisville and will be managed by Robert Montgomery, manager of the commercial department of the Louisville Gas & Electric Co. Mr. Montgomery managed the two previous Louisville shows held in 1915 and 1916.

Arrangements are being made to have all the electrical and engineering organizations of Kentucky and Indiana hold their annual conventions in Louisville while the exposition is in progress, and as a large attendance of central-

station men, dealers and manufacturers from both states will be solicited, the major portion of exhibit space will be occupied by manufacturers.

A committee of the illuminating engineers and professional decorators has devised a decorative scheme for the huge armory that will be unique in the extreme. The motive of the decorations is to be "winter." The interior of the armory will be snow white and all surfaces of the wooden structures will present the glittering appearance of snow and ice. The center piece will be a gigantic electric fountain, the water from which will rise 50 ft. in the air. Above the exhibit spaces, around the walls of the building, will be depicted the scenic effect of the aurora borealis and Iceland scenes.

WISCONSIN ELECTRICAL MEN WILL MEET IN MILWAUKEE.

Central-Station Problems to Be Considered at Twelfth Annual Convention of Wisconsin Electrical Association.

Members of the Wisconsin Electrical Association will hold their twelfth annual convention in Milwaukee, Wis., March 24 and 25, with headquarters at the Hotel Pfister. The convention will open with a joint session on March 24 of the electrical association and the Wisconsin Gas Association, at which papers will be read by William C. Knoelk, executive secretary, Community Service of Milwaukee, on "The Leisure-Time Factor," and by M. E. Sampsell, president of the Wisconsin Power, Light & Heat Co., on "Matters of Mutual Interest."

Following the joint session, the electrical association will dispose of its routine business, after which a number of papers will be presented and discussed during the Wednesday afternoon session and continuing during Thursday session. The papers to be presented follow: "The Relations of the Central Station to the Public," by M. H. Aylesworth, executive manager of the National Electric Light Association; "Cost of Production Less Depreciation," by Paul Stark, general auditor, Eastern Wisconsin Electric Co.; "Possibilities in City Street-Car Operation," by E. M. Walker, general manager, Terre Haute, Indianapolis & Eastern Traction Co., Terre Haute, Ind.; "The Development of Automatic Substation Equipment," by C. A. Butcher, switchboard engineering department, Westinghouse Electric & Manufacturing Co.; a general discussion on "Electrical Appliances and the Central Station," and a special report by C. A. Neff of the "Extension of Rural Lines."

On Wednesday evening there will be a joint banquet of the two associations at the Milwaukee Athletic Club, at which Edward J. Dempsey, Oshkosh, Wis., will preside at toastmaster.

ADVANTAGES GAINED BY USE OF DOMESTIC REFRIGERATION.

In a recent paper on domestic refrigeration by Robert Montgomery, manager of the commercial department of the Louisville (Ky.) Gas & Electric Co., he pointed out five facts that he claims demonstrates the advantages of domestic refrigeration. The points made by Mr. Montgomery are as follows:

"The average family that is financially able to purchase a refrigerating machine is using not less than $4 worth of ice per month. The cost of ice for one domestic customer before purchasing a refrigerating machine averaged $10.25 per month for the previous 12 months. The retail price of ice in Louisville is 50 cents per 100 lbs.

"(1) If a moderately low rate can be obtained for electric service a substantial saving can be effected over the cost of ice.

"(2) Absence of moisture and water from the melting of ice.

"(3) Absence of any foreign matter which may be introduced to the ice-box with the ice.

"(4) Elimination of annoyance of removing and replacing articles when ice is put into the box by the ice-man.

"(5) Considerable time and annoyance is saved the housewife in that it is no longer necessary to display ice-cards in the window, remain at home awaiting the appearance of the ice-man and, most important of all, when she leaves the city for a day or two she may return with the assurance that the food in the refrigerator is in a state of excellent preservation and that she will have ice for use on the table for the following meal."

IRON AND STEEL ELECTRICAL ENGINEERS PLAN MEETINGS.

The Association of Iron and Steel Electrical Engineers has issued an announcement of meetings and inspection trips that will occur in the near future. The first of these held in the Hotel Chatham, Pittsburgh, on March 20, was a dinner followed by a meeting at which T. D. Lynch presented a paper on "Babbitt and Babbitting."

"Grounded Neutral" is the subject of a paper to be read by Robert B. Treat, at Pittsburgh, April 17. From the same city the Association plans an inspection trip to the Trumbull Steel Co., Warren, O., May 22. "Current Limit Reactance" is the title of a paper by R. H. Keil, which he will present at Pittsburgh, June 12.

Association activities in Philadelphia consist of the reading of a paper on "Welding, Electrical vs. Gas," by James E. Wilson on April 3; a trip to the Lukens Steel Co., at Coatesville, Pa. some time in April; announcement of results of election of officers and discussion of the application of electricity to the iron and steel industry at a meeting May 1 and the annual outing June 5.

SMELTING IRON ORE IN AN ELECTRIC FURNACE.

Seattle Company Installs First of Three 1-Ton Furnaces for Smelting of Magnetite Ore.

The smelting of iron ore in an electric furnace has been put in practice, on a comparatively small scale, by the Smelters Steel Co., of Seattle, Wash. The design of the furnace employed is that of G. L. Casey, president of the company, and has a producing capacity of about 5 tons of soft gray iron per 24 hours.

The company has 5 acres of ground on Commercial Waterway, at slip No. 5, just outside

the city limits of Seattle. The main building is a wooden structure, within which is a transformer room, 12 by 60 ft., 30 ft. high, of interlocking clay tile. This contains three 440-kv-a., single-phase transformers, for 13,200 volts high tension, and 55 and 65 volts low tension. One transformer is required for each furnace. While only one is in operation, a second is being installed and plans provide for a third furnace at a later date. There are, also, three 25-kv-a. transformers for motor and lighting service at 220 and 110 volts. A motor-generator set, comprising a 7½-hp. motor and a 5-kw. generator, supplies direct current to operate a Thury regulator for controlling and regulating the amount of electrical energy in the furnace.

The furnace consists of a cylindrical crucible of boiler-plate steel, boshed at the base and lined with fire-brick. It is about 8 ft. in diameter and 12 ft. high, and the heat is centered in an amorphous carbon electrode, 14 ins. in diameter, that stands in a vertical position, and is the joinable type. As the electrode is consumed at the lower end, a new section is attached at the top. The furnace has a carbon bottom, carrying the current from the electrode to the outgoing cable, thus creating a circuit.

The charge, which is fed in at the top, contains about 2000 lbs. of iron ore, to which is added the necessary limestone and coke. The coke is required only as a reducing agent, the amount used being only about one-third of that required in a blast furnace. The carbon of the coke absorbs the oxygen, leaving a metallic iron. The electrode is handled by electric power. The product carries from 1.5% to 2% silica, and the slag is practically free of iron content.

The present unit draws about 7000 amperes at 65 volts, under normal conditions. The ore, consisting of magnetite, is transported to the plant in barges from the company's open-cut mine on Dean channel, British Columbia. This ore, which runs about 50% iron, is low in sulphur and low in phosphorous. The product thus far has been sold to local foundries.

The Westinghouse Electric & Manufacturing Co. furnished the electrical equipment, and the electric power is supplied by the Puget Sound Traction, Light & Power Co.

PLAN ELECTRIFICATION OF RAILWAYS IN COLONY OF JAMAICA.

An electrical engineer of the Westinghouse Electric International Co. has reported to the Government of Jamaica on the proposal to adopt electric traction on the railway of the colony and to provide electric power for industrial purposes. The estimated cost of electrifying the railway, including the power station, equipment and transmission lines to supply other industries, is put at nearly $3,400,000. The power plants would cost $849,320, substations $333,320. overhead construction $1,854,300, electric locomotives and motor cars $357,650, a total of $3,393,590. The London (Eng.) *Times* Trade Supplement reports that the saving in the cost of operating the railway would be approximately $265,600 per annum, or 7.83% of the cost of electrification, assuming the supply of power to outside consumers at cost. The sale of power to outside consumers would result in a profit sufficient to increase the return on the cost of electrification to 10.5%. If the scheme is carried out some of the power would be used to operate plants on some of the sugar estates, to supply power for the sewerage and for the lighting of the thoroughfares of Kingston, the capital city of Jamaica, and in other districts throughout the colony.

SAFETY ENGINEERS TALK ON ELEVATOR HAZARDS.

The American Society of Safety Engineers held a meeting in New York March 19, at which the following papers were presented: "Elevator Hazards," by C. N. Young; "Development of Elevator Safety," by David Linquist; "Elevator Interlocks-Mechanical," by C. W. Old; "Elevator Cable Safety," by John W. Troescher, and "What Constitutes Proper Elevator Inspection," by D. J. Gitto.

WESTINGHOUSE ACQUIRES INTEREST IN GEORGE CUTTER CO.

The George Cutter Co., South Bend, Ind., announces the acquisition by the Westinghouse Electric & Manufacturing Co., of a financial interest in its company. The management and the commercial policies will remain unchanged, but advantage will be taken of the Westinghouse enginering and other facilities to expand the Cutter company's activities and develop its lines to enable it to more effectively serve its customers and the industry.

The Westinghouse company will operate as sole distributors for the Cutter company's products.

COMMONWEALTH-EDISON CUSTOMERS BUY COMPANY'S STOCK.

The week of March 1 to 8 was "Monroe Week" in the campaign of Commonwealth Edison Co., Chicago, for the sale of securities to customers and residents in its territory. It was so named in honor of Charles A. Monroe who is one of the vice-presidents of the Company. During this week 816 shares were sold. A banquet will mark the close of the sale of these securities to small holders.

ELECTRICAL FURNACES DISCUSSED AT PHILADELPHIA.

At a joint meeting of the Franklin Institute of the State of Pennsylvania and the Philadelphia Section, American Institute of Electrical Engineers, held March 17, G. H. Clamer gave a lecture on the "Induction Electrical Furnace." He traced the development of the induction furnace in its various forms from the original conception by Colby of the single-turn open-ring type to the latest developments by Dr. E. F. Northrup in the use of high-frequency induction heating. Mr. Clamer discussed the various fluid motions due to electrodynamic forces and their use in several forms of induction furnaces, paying particular attention to the commercial operation of induction furnaces using both high and low-frequency currents.

ENGLAND RECOVERING FROM WAR, DECLARES CARLTON.

Newcomb Carlton, president of the Western Union Telegraph Co., on his recent return from London stated that labor in England has "rolled up its sleeves" and that the country is recovering rapidly. A wave of prosperity is affecting everything in England, he declared, and he found the same to be true of Holland. Mr. Carlton expressed the opinion that wireless telegraphy is an emergency affair and will never supplant the cable system. His experience in using the wireless telephone when 1500 miles from Liverpool was that he could barely distinguish what was said. New York telephone service is much superior to London service as observed by the head of the Western Union.

TO BUILD STEINMETZ MOTOR CARS AT BALTIMORE PLANT.

Steinmetz electric power automobiles, recently perfected by Charles P. Steinmetz, chief engineer of the General Electric Co., Schenectady, N. Y., will be assembled in Baltimore by the Steinmetz Electric Motor Car Corp., which has capital stock of $2,000,000. The company will purchase a completed plant in Baltimore and according to N. W. Truett, secretary, will have a capacity of 4000 cars a year and will employ between 300 and 400 men. Light delivery cars and an industrial truck will be built. The approximate cost of the buildings and machinery will be about $250,000.

PENNSYLVANIA ELECTRIC ASSOCIATION TO HOLD MEETING.

Announcement is made of the meeting of the Eastern Geographical Section of the Pennsylvania Electric Association, to be held at the Hotel Adelphia, in Philadelphia, on March 25. Representatives from central-station companies in other parts of the state, as well as the eastern part, together with representatives of various electrical manufacturing companies, plan to attend the meeting, which will be addressed by a number of men prominent in the electrical industry.

SIOUX FALLS-PIPESTONE TRANSMISSION LINE IN SERVICE.

The 50-mile, 33,000-volt transmission line connecting the Pipestone, Minn., division of the Northern States Power Co., with the company's power station at Sioux Falls, S. D., has been completed and service was inaugurated Feb. 24. The plant at Pipestone will be maintained hereafter only for reserve use.

ELECTRICAL APPLIANCES INTEREST RAILWAY SHOW VISITORS.

Electrically operated signaling, utility and safety devices used in railway work were the chief objects of interest at an exhibition held by the National Railway Appliances Association at the Coliseum, Chicago, March 15-18. The exhibition was held in conjunction with the annual meeting of the association.

EDISON CLUB ANNOUNCES PRIZE CONTEST FOR MEMBERS.

Two members of the Edison club of the Commonwealth Edison Co., Chicago, will have free trips to the convention of the National Electric Light Association in Pasadena, Cal., next May, Members of the club have been invited to write a paper on the following topic suggested by Samuel Insull, president of the company, "Methods of Keeping the Good-Will of the Customers of the Commonwealth Edison Co." A prize of a free trip to the convention will be awarded to the male employe writing the best paper and a similar award to the female employe.

COMING CONVENTIONS.

Wisconsin Electrical Association. Annual convention, Milwaukee, Wis., Mar. 23-25. Headquarters, Hotel Pfister. Secretary, E. J. Pulliam, 1408 First National Bank building, Milwaukee, Wis.

American Electrochemical Society. Annual convention, Boston, Mass., April 7-10. Friday, April 9, joint session with American Institute of Electrical Engineers on "Electrically Produced Alloys." Secretary, Joseph W. Richards, Bethlehem, Pa.

American Association of Engineers. Annual convention, St. Louis, Mo., May 10 and 11. Headquarters, Planters Hotel. Secretary C. E. Drayer, 63 East Adams street, Chicago.

Electrical Supply Jobbers' Association. Twelfth annual convention, Del Monte, Cal., May 12-14. Franklin Overbagh, general secretary, 411 South Clinton street, Chicago, Ill.

Southwestern Electrical and Gas Association. Annual convention, Galveston, Tex., May 13-15. Headquarters, Hotel Galvez.

National Electric Light Association. Annual convention, Pasadena, Cal., May 18-21. Headquarters, Hotel Huntington. Acting secretary, S. A. Sewall, 29 West 39th street, New York City.

American Institute of Electrical Engineers. Annual convention, White Sulphur Springs, W. Va., June 29-July 2. Headquarters, The Greenbrier. F. L. Hutchinson, secretary, 33 West 39th street, New York City.

Ohio Electric Light Association. Annual convention, Cedar Point, Ohio, July 13-16. Secretary, D. L. Gaskill, Greenville, Ohio.

Pacific Coast Section, American Institute of Electrical Engineers. Annual convention, Portland, Ore., July 21-23.

National Association of Electrical Contractors and Dealers. Annual convention, Baltimore, Md., Oct. 6. Secretary, W. H. Morton, 110 West 40th street, New York City.

NEW YORK SECTION, N. E. L. A., HEARS ADDRESS ON "AMERICANISM."

Maj. F. H. LaGuardia, president of the New York City Board of Aldermen, addressed the New York Companies Section of the National Electric Light Association at meeting held March 16 at the New York Edison Co. auditorium. Major La Guardia took as his subject "Americanism." Following the address Walter Neumuller, secretary of the New York Edison Co., read a paper on "At Your Service as Viewed From Behind the Scenes."

COMMERCIAL PRACTICE

New-Business Methods, Policies, Rates and Kindred Central-Station Matters for the Man Engaged in Selling Electricity

SOLVING THE INCREASING COST OF CENTRAL-STATION OPERATION.

Larger Annual Income Per Kilovolt-Ampere of Capacity Is Solution of Problem—Rate Increases Granted Are Not Adequate.

The ever increasing cost of operation of public utilities since 1914 has become a serious menace to the country, writes R. F. Benginger, sales manager of the Electric Furnace Co., Alliance, O., in the last issue of *The Electric Furnace*. Continuing, Mr. Benginger says that while the demands for service upon this branch of the industry are ever increasing, which demands must be met to assure industrial prosperity, the earnings of the central-station companies have declined at an alarming rate, making it difficult to secure the necessary capital, not only to make the necessary extensions and improvements but in some cases even to maintain the present service at a high point of efficiency.

It is true that rate increases have been granted, but these have been far from adequate and great credit must be given to our utilities for the manner in which these properties have been operated to obtain the maximum efficiency in every department.

The largest items entering into the cost of operation are, of course, fuel, labor and new equipment. Fuel and labor have practically doubled since 1914, whereas equipment has increased anywhere from 50 to several hundred per cent.

In the boiler room of the power plant everything possible has been done to increase the amount of steam obtained from a pound of coal by the installation of stokers, economizers, draft regulators, flue gas-analysis, machines, etc., and the results have been gratifying indeed.

In the turbine room more efficient machines have, where possible, replaced less efficient apparatus. Water conditions have been bettered to obtain better vacuums, great care has been exercised to operate the most economical combination of generating units for every combination of load. Coal and ash handling apparatus has been installed. In fact, plant operators have made every effort to increase the over-all efficiency of this part of the industry.

The distribution and transmission systems received every attention, voltages have been raised, transformers redistributed and other changes made, and the losses of transmission and distribution have been reduced.

The third item, namely, the cost of new equipment, and, of course, all repair parts are beyond the control of the operator.

It is, therefore, apparent that not much can be hoped for from these departments to relieve the situation. However, relief may be obtained by increasing the load-factor of the entire system, inasmuch as the average central station is operating with an annual load-factor of between 50 and 60%, and, in many cases even lower than this. This fact has, of course, been recognized and has resulted in considerable interconnection of properties to take advantage of the diversity-factor.

It is apparent that a plant and distribution system operating at 50% annual load-factor would very materially reduce its operating ratio and thereby increase its earnings for every per cent that its load-factor could be raised.

In other words, if a system operating at 50% annual load-factor showed a cost of generating and distributing energy, including fixed charges of 1½ cents per kw-hr., with an average fuel consumption of 2½ lbs. of coal costing $4 per ton delivered, the cost of energy delivered, operating at 60% annual load-factor, would only be 1.34 cents per kw-hr., as the only increase in expenses would be the additional cost of fuel and fuel handling.

This decrease is figured on a plant at 60% load-factor, consuming the same amount of coal per kw-hr., namely, 2½ lbs., as it would at the 50% load-factor, whereas, of course, the coal consumption would drop, due to the fact that the turbines would operate at nearer maximum rating for 24 hours; boilers would then require less banking and the ratio of power used by the station auxiliaries to the total power generated would be less.

Of course, the rates charged by the central stations are based on load-factor; however, a careful analysis will show the great effect which several extremely high load-factor customers would have on the total operating costs of a plant, reducing the cost of all energy generated.

The new-business department of a central-station company should, therefore, be keen indeed to secure new business having high load-factor and, if possible, of course, high power-factor, as this class of business should not be merely considered as an increase of so much per year in revenue, but should be considered as a reducing agent for the present operating cost, affecting materially the net earnings.

Such desirable business includes in the industrial field electric ovens and furnaces and other apparatus requiring heavy energy, while in the household field automatic refrigerating, electric ranges, washing machines and other devices come under this head.

PUBLIC UTILITIES NOW NECESSITIES, NOT LUXURIES, SAYS ATTORNEY.

"The day has gone by when the service rendered by a public service corporation can be regarded as a luxury," said Attorney James A. Farmer of Belleville, Ill., speaking before the Belleville Commercial Club. "These utility com-

panies have now come to be a necessity in our lives. We do not go out and get a bucket of water any more, nor do we use tallow candles for lighting purposes.

"One would think the corporations were like Captain Kidd from the way they are regarded by some people," he continued. "This prejudice is oppressive to the companies, and it eventually affects their credit. Bond brokers hesitate to sell bonds or extend financial aid and the result is that the companies cannot keep up their property nor take steps to expand.

"It is true that utility companies rely solely upon us for support, but it is also true that we rely upon these companies. Business men should see the necessity of eliminating this prejudice by pointing out the needs of the company to the growth and welfare of the city. No community would persecute its merchants or manufacturers and prevent them from growing and bringing greater prosperity to the city. Then why continue to upbraid the service companies without which the community can not exist?"

THE OBLIGATIONS OF UTILITY COMPANIES TO PUBLIC DEFINED.

Meter Department Foreman Outlines Function of Public Service Companies and Their Dutv to Communities Served.

In a contest recently conducted by the Empire State Gas and Electric Association, employes of the member companies were invited to submit contributions on the subject of "Our Obligations to the Public." A large number of contributions were received and submitted to M. H. Aylesworth, executive manager of the National Electric Light Association, who acted as judge. The first prize was awarded to A. G. Strickrott, foreman of the meter department, Mohawk Edison Co., Schenectady, N. Y., whose contribution follows:

"The obligation of a gas and electric company to the public is to exemplify the idea that a commodity such as ours, possessing as it does the peculiar problems of development, production and distribution, can be made most easily available and most economically serviceable to the public when promoted on a large scale by a private corporation.

"The public's obligation has ceased when it has given the company valuable privileges and franchises to conduct such a business, and recognizes the company's right to charge for this service an amount which will net it a fair return. The public then feels, and justly so, that this business is a monopoly controlling some of the necessities of life, and the justification of continuing such an institution will depend upon its personnel, the manner in which it renders this service, and the interpretation of its privileges and its standing in the community.

"The company and its employes then are public servants, maintained to conduct a business along safe, economical, reliable and progressive lines and not one clothed in hazard, mystery and suspicion. Open dealings, open doors, smiling faces and accessible officials are necessary, making the office a pleasant place to come and where criticisms and complaints will receive just consideration in a courteous and indiscriminate manner. It must develop its territory to the fullest extent, making its service available and economical to the public, developing business and industry, lightening household burdens and adding comforts to the great majority. It should consider its consumers as clients, looking to it for advice and means to meet their daily wants, and that confidence should be established and maintained by a display of prompt, willing, smiling, personal service all along the line with this obligation: 'The public be pleased.'"

REASONS FOR BURNOUTS IN ELECTRICAL MACHINERY.

In a recent issue of *Elektrotechnik and Maschinenbau,* attention was drawn to the disastrous effects that may arise from iron filings when, through carelessness in construction, they exist in cavities in the iron cores of electrical machinery. In large units considerable voltages (of the order of a few tenths of a volt) may occur between neighboring plates or other parts. If iron fillings or chains of filings bridge across such places, very high local temperatures may obtain through development of Joulean heat—0.2 volt would suffice to heat an iron particle to 1000 deg. C. inside a fraction of a second. A burn may result where the insulation between laminae is destroyed. The local losses then increase, and breakdown follows in severe cases. In investigating certain cases of transformer burnouts there were found in the cores big lumps of solidified iron filings, forming welds across bundles of plates.

TESTS SHOW HIGH EFFICIENCY OF CORE-BAKING OVENS.

From actual tests of electrically heated core-baking ovens recently made at the plant of the Muncie Foundry & Machine Co., Muncie, Ind., it was found that the pounds of cores baked per kw-hr. ranged from 10.88 to 14.6, varying with the size of the cores. These weights vary from a small piston core weighing 1⅔ lbs. to a large chunk core, weighing 128 lbs., the total during the test being 108,730 lbs.

The total power consumption for this test was 9389 kw-hrs., giving an average efficiency of 11.6 lbs. of green cores baked per kw-hr. of power consumed. The tests were conducted with four ovens, each having 72 kw. in heaters installed. As a consequence of the results secured during a year's operation, the foundry is now installing four more similiar ovens and recently ordered 20 more as additional equipment.

EMPLOYE'S WAR RELICS USED TO MAKE WINDOW DISPLAY

The Northern States Power Co. at Minot, N. D., recently had an interesting window display, consisting of war relics brought back by W. J. La Victoire, one of the company's employes. Included in the display were German shells, German and American hand grenades, helmets, paper sand bags, a piece of a paper sheet under which Mr. La Victoire slept while at Strassburg and shrapnel shell picked up on the Verdun battlefield.

OPERATING PRACTICE

Methods and Problems Embracing Operation and Installation of Power-Plant Equipment and the Distribution of Electrical Energy

COMPLETE CONSTRUCTION OF THE LARGEST SYNCHRONOUS CONDENSER.

Machine with Capacity of 30,000 Kv-a. and Speed of 600 r.p.m. to Be Installed in California.

The trend in the design of synchronous condensers is continually toward higher speeds and larger capacities, according to a statement in the February issue of *General Electric Review*. The largest condenser under construction is a 30,000-kv-a., 6600-volt, 50-cycle, 10-pole 600-r.p.m. machine, capable of operating at 20,000 kv-a. lagging, which will be installed in the Eagle Rock substation of the Southern California Edison Co.

The rotor, instead of being built of the usual steel castings, is built of steel plates in four sections. Each section consist of a number of ½-in. plates and 2-in. plates riveted together and shrunk on the shaft. The rotor center was heated to approximately 80 deg. C. above the room temperature for assembling on the shaft, and the rotor spider and shaft will be shipped assembled. The bearings are arranged for water cooling and oil pressure will be used when starting. The direct-connected exciter is of 150-kw. 250-volt capacity and is compound wound. The exciter armature has a stub shaft with forged coupling and is bolted to the end of the condenser shaft. The magnet frame of the exciter is supported by the bearing housing. The condenser is to be started by a compensator in connection with a 50% tap in the transformer. The potential taps available will be 30, 37.5 and 40% of normal voltage.

Hoods for the intake of approximately 83,000 cubic feet of air per minute are part of the design, the air being vertically at the top. A special double ventilating hood is provided for admitting this amount of cooling air, which is drawn into the rotor by the poles and fans. On account of the very long stacking and the amount of air required for cooling, the fans at each end of the rotor are double and have curved blades. The guarantees on the condenser for continuous operation are 50 deg. C. by thermometer and 60 deg. C. rise by temperature coil, except the field, which will be 80 deg. C. rise by thermometer. Special attention has been directed to the elimination of those harmonics in the wave shape that would produce interference with communicating lines.

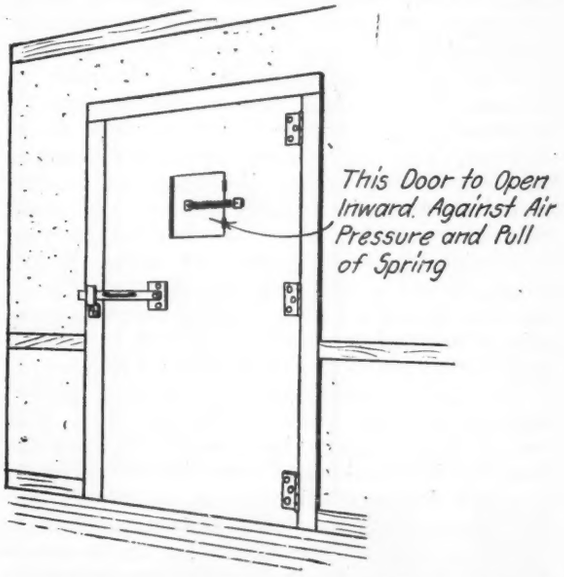
The condenser has been thoroughly tested, including several heat runs of such kind as it is customary to make on large machines of this kind when it is possible to operate under actual load conditions. The result of these tests show that windage, friction and hysteresis losses have been reduced beyond expectations. The ventilation has also proved highly satisfactory.

MAKING ACCESS TO AIR DUCTS MORE EASILY ACCOMPLISHED.

Use of Auxiliary Door in Main Door Permits Equalization of Air Pressures.

By W. B. SMITH.

With air-cooled transformers an air pressure of about ¾ oz. per sq. in. is usually employed as being sufficient pressure to enable the requisite amount of air to be forced through the air duct and through the ventilating ducts and openings in the transformers. In a station containing several thousand kilowatts in transformer capacity one large blower but more often two smaller blowers, either one of which is capable of cooling



Auxiliary Door to Permit of Equalizing Air Pressures and Makes Access to Air Duct Easier.

all the transformers at one time, is installed. There is a large amount of air being passed and quite high velocity.

The air duct usually offers the means of access to the terminals of the transformers for the lower voltages, it frequently is used as a cable duct, for the conductors from the transformers at least, and sometimes is used as a convenient place for storing induction regulators, etc. In any case the air duct must permit of ready access for men and materials. As it is best that the air supply continue whether men are entering or working in the air duct or not, means must be provided for entering and leaving the air duct against the pressure existing in the duct.

That air may be forced through the transformers, leaks through cracks and crevices should be avoided, as air will escape along the path of least resistance or where the friction is lowest. The

door to the air duct is usually sufficiently large to not only permit one man to pass through it standing up but also apparatus of the smaller sort, as small potential transformers for metering, for station lighting, etc. A door to permit of this will measure 3 to 4 ft. wide and 5 to 6 ft. in height or between 15 and 24 sq. ft. in area. With an air pressure of ¾ oz. or more per square inch it can be seen that the pressure exerted upon the door of the air duct is appreciable; in fact, it is so high that it may be impossible to open or close the door unless special arrangements exist for reducing the air pressure exerted upon the door.

The most common method of overcoming the air pressure is to install a double door, between which is an air space of sufficient width to permit of a man standing up while both doors are closed. The outer door can then be opened easily while the person entering the air duct stands between the doors, closing the outer door after him. He then is able to open the inner door with comparative ease, once it has been opened a little way to permit air to enter the air space between the doors, and in this way equalize pressures.

However, when the inner door is airtight so that practically no leakage occurs, and the doors are large and the air pressure high, it may be quite hard work to open the inner door even with duplicate doors. In any case it is desirable to facilitate matters where men are passing through incessantly, as when construction work is in progress. This can be done very cheaply, and at the same time overcomes all difficulty on account of high pressure, by building into the inner door an auxiliary door as shown in the accompanying illustration. It should measure about 8 ins. square, should be held closed against the air pressure and by a good strong spring when no pressure is on, and when closed should be such a good fit that practically no air leaks through.

With the auxiliary door installed, a person entering the duct, after opening the outer door and closing it again, has merely to open the auxiliary door and hold it open for a fraction of a minute during which time the air rushes into the chamber between doors, equalizing them so that practically no pressure exists on the inside door and that the inside door can then be opened with ease. This simple little arrangement will be found to save much effort where the doors in the air duct are large, where the air pressure is high and where they have to be opened and closed quite often, and frequently by a man carrying tools and materials.

OPERATING RESULTS WITH PULVERIZED COAL.

Data Obtained by Milwaukee Electric Railway & Light Co. During Five-Day Test.

In a paper presented by John Anderson, chief engineer of power plants, Milwaukee Electric Railway & Light Co., on Feb. 19 before the Employes' Mutual Benefit Association of that company, the experiences and operating results being obtained with pulverized coal were given out for the first time.

The installation in question, at the Oneida Street station of the Milwaukee Electric Railway & Light Co., consists of five 468-hp. water-tube boilers. From Nov. 11 to 15 of last year a test was conducted on the entire installation, or five boilers. The test lasted over a period of 99 hours and is believed to be one of the most complete and sustained tests ever conducted. These facts alone make the results of special interest, while the fact that pulverized coal was used and that the installation is the largest in existence using this form of fuel adds to the interest.

ELECTRIC ENERGY AND FUEL CONSUMPTION PER TON OF COAL PULVERIZED.

1. Energy consumed by conveyors, crushers, elevators, dryer, blowers and feeders, kw-hr.	5.73
2. Energy consumed by pulverizer, kw-hr.	16.72
3. Total energy, kw-hr.	22.45
4. Coal equivalent at 1.5 lbs. per kw-hr, lbs.	33.68
5. Coal consumed in dryer furnace, lbs. per ton of fuel dried	25.66
6. Total coal and equivalent, lbs.	59.34
7. Gross efficiency less deductions for total coal and equivalent	78.36
Cost of Fuel Preparation, Firing and Ash Disposal.	
8. Labor—coal preparation	$0.143
9. Labor—firing	.112
10. Labor—ash removal	.025
11. Dryer fuel—coal at $4 per ton.	.051
12. Electric energy—coal per kw-hr. at 1.5 lbs.	.068
13. Maintenance (labor at 3.6c, material at 2c, manufacturer's estimate, lubricants at 0.7c)	.063
14. Total cost of fuel preparation, firing, ash disposal and maintenance	.462
15. Price of coal as purchased, per ton.	4.000
16. Total cost	4.462
Efficiencies.	
17. Actual gross efficiency, per cent.	80.67
18. Net efficiency after all incidental costs have been accounted for, per cent.	72.32

COMPARISON OF COSTS AND NET EFFICIENCIES—ELECTRIC ENERGY AND FUEL CONSUMPTION PER TON OF COAL BURNED.

	Pulv. fuel system.	Modern stoker.
Energy consumed by conveyors, crusher, elevators, dryers, fan and feeders, kw-hr.	5.73	10.94*
Energy consumed by pulverizer, kw-hr.	16.72	.....
Total energy, kw-hr.	22.45	10.94
Coal equivalent at 1.5 lbs. per kw-hr., lbs.	33.68	16.41
Coal consumed in dryer furnace, lbs.	25.66	.....
Total coal and equivalent, lbs.	59.34	16.41
Cost of Fuel Preparation, Firing and Ash Disposal.		
Labor—coal preparation	$ .143	$ .000
Labor—firing	.112	.140
Labor—ash removal (in plants)	.025	.064
Dryer fuel—coal at $4 per ton.	.051	.000
Electric energy—coal per kw-hr., at 1.5 lbs.	.068	.033
Maintenance— Labor at $0.036, material at $0.020, manufacturer's estimate; lubricants at $0.007	.063	.097†
Total cost of fuel preparation, firing, ash disposal and maintenance.	.462	.334
Price of coal as purchased, per ton.	4.000	4.000
Total cost, per ton.	4.462	4.334
Cost per ton of coal in powdered coal system over modern stoker.	.128	.....
Efficiency.		
Actual gross efficiency, per cent.	80.67	76.80
Net efficiency after all incidental costs have been accounted for, per cent.	72.32	70.88
Difference in favor of pulverized fuel system, per cent	1.44	.....

*Stokers and blowers, kw-hr.
†Labor, $0.046; material, $0.049; lubricants, $0.002.

NEW APPLIANCES

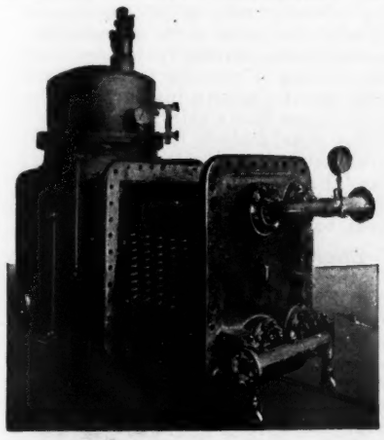
Newly Developed and Improved Electrical and Mechanical Apparatus, Appliances, and Devices Now Being Placed on the Market

System of Water Purification for Power Plants.

The development of feed-water purification by evaporation in the marine field has extended over more than 50 years, but it was not to any extent applied to stationary power-plant practice until about five years ago. It is noteworthy that the great power plant advances are generally fostered and first used in marine practice, because operation on board ship demands high-grade equipment, minimum shutdowns and greatest ease of repairs.

From time to time some of these marine products have been adopted in stationary power-plant practice, and the past five years has seen the introduction of Reilly evaporators for purification of boiler feed make-up in large central station plants, and also in plants of various sizes even to the very small ones. The Reilly evaporator is manufactured by the Griscom-Russell Co., 90 West street, New York City.

Purification of water in central-station plants is accomplished in a similar manner to the established ship-board procedure, with the exception that the refinements of operation are even greater, and plants are so arranged that practically all heat used in the evaporation of the water by the use of steam, is returned to the system. In the actual operation, high-pressure steam is supplied to the coils of the evaporator, and, in condensing in these coils, evaporates the body of water in the shell surrounding the

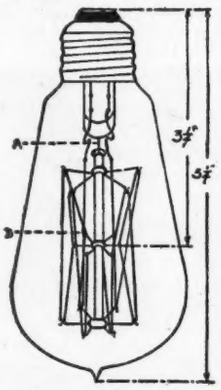


Submerged Type of Reilly Evaporator.

coils. This purified vapor is in turn condensed in a condenser and is ready for boiler feed. This is descriptive only of the basic feature of the plant, and it is the plan of utilizing the hot-well water as the condensing water, and other features, which make the system not only a valuable means of purification but also permits the apparatus to pay for itself in actual savings in from six months to one year beside resulting in a saving in wear on boiler tubes through the use of purified water.

Westinghouse Mill-Type Mazda Lamp.

Before the advent of the mill-type Mazda lamp incandescent lamps were used where they were subjected to vibration and sudden shocks, but such lamps were invariably of the old carbon-filament type, in which strength was



New Westinghouse Mill-Type Lamp.

obtained at the expense of illumination. In order to secure a lamp that would combine the shock-resisting qualities of the carbon lamp with the efficiency and brilliancy of the modern Mazda lamp, the Westinghouse Lamp Co., 165 Broadway, New York City, has developed and placed on the market its new mill-type Mazda lamp.

This lamp is similar in general appearance to the ordinary vacuum Mazda "B" lamp, but instead of the entire stem being of one piece a flexible, shock-absorbing, steel-spring shank, as shown at "A," in the accompanying illustration, is inserted between the arbor and the press, thus enabling the arbor and filament to vibrate freely in all directions without displacing anchors or short-circuiting the filament loops.

Another feature claimed for the mill-type lamp is the method of anchoring the filament. Instead of the usual top and bottom anchors, as found in the ordinary lamp, an additional set of anchors is supplied at the center of the arbor, as shown at "B." By lacing the filament to this extra set of anchors, it is prevented from becoming tangled when subjected to severe jolts or sudden shocks such as occur during blasting in mines, in the knock-about service in mills and factories, in extension-cord work about garages, in engine and boiler rooms, machine shops, textile mills, drop forges, on steamboats, street cars, etc.

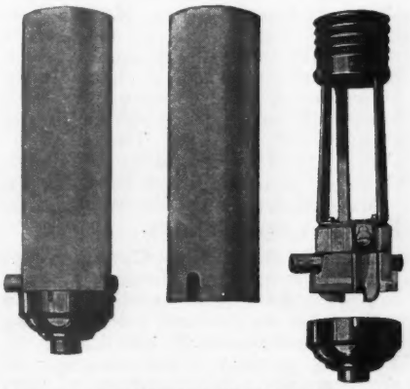
Where carbon-filament lamps have been used because of their longer life, the manufacturer states the mill-type lamp offers not merely the economy resulting from reduced breakage but also the advantages of vastly improved illumination.

These lamps are furnished in 25 and 50-watt sizes, S-19 bulb, and in 110-125 and 220-225 voltage ranges. The retail price of the 110-volt lamp is 45 cents, while that of the 220-volt lamp is 48 cents.

New Cap Catch for Candle-Length Socket.

A new push socket of the candle-length type, which is being manufactured by the Cutler-Hammer Manufacturing Co., Milwaukee, Wis., differs from the former C-H candle-length socket in that it has an improved cap catch which enables the socket shell and switch to be attached to the cap by a slight turn of the fiber candle shell. An opposite turn or twist detaches the candle, socket and switch so that they can be lifted from the cap. The illustration shows the fiber candle, socket shell and switch assembly, and cap.

The new cap consists of the ordinary socket cap with a concentric sleeve over the enlarged end. Three notches in the sleeve coincide with similar notches in the cap proper, and are spaced to receive three short stubs projecting radially at the bottom of the fiber candle. When the fiber candle is inserted in the cap and given a slight turn, the sleeve moves with it, and the holding stubs of the candle follow horizontal slits in the stationary cap. The candle is therefore locked and held at three distinct points. This insures firmness and



Candle-Length Socket, Showing Assembly, Shell and Switch Mechanism.

stability to the assembled socket, whereas when the candle is held at fewer than three points any disturbance such as jarring or handling sometimes deflects it from its natural upright position. The C-H standard quick make-and-break mechanism used in all C-H push sockets and switches is employed.

This candle-length socket is likened to a standard C-H socket.

ACTIVITIES IN THE TRADE

Business Developments, Sales Agencies, Trade Literature and Miscellaneous Items Concerning Electrical Manufacturers and Allied Business Interests

Templeton, Kenly & Co., Ltd., 1020 South Central avenue, Chicago, manufacturers of pole and railroad jacks, has issued bulletin No. 820 giving details of its "Simplex" track jack, built with a square lever socket.

Morse Chain Co., Ithaca, N. Y., has opened branch offices at 1402 Lexington building, Baltimore, Md., in charge of E. R. Morse, as manager and at 302 Harrison building, Philadelphia, Pa., with M. H. Rodda, as manager.

Electric Furnace Co., Alliance, O., has opened a middle-western states office at 301 Frisco buildingg, St. Louis, Mo., with W. E. Prosser in charge. The demand for Baily electric furnaces for melting non-ferrous metals made this step necessary.

Esterline Co., Indianapolis, Ind., has issued bulletin No. 395 giving details of their new power-factor recording instruments. The bulletin points out that the subject of proper instruments is of importance to all users of a-c current generators and motors. It also contains several articles on power factor in central stations and industrial plants.

Electric Storage Battery Co., Allegheny avenue and 19th street, Philadelphia, has published a booklet entitled "15 Points on Ironclad-Exide Batteries," showing numerous applications of the batteries in railway and wharf haulage and in mines, together with details regarding battery construction.

American Steam Conveyor Corp., 326 West Madison street, Chicago, announces the appointment of the Kon-Wald Engineering Co., Mutual Life building, Buffalo, N. Y., as its representative in Buffalo and western New York state. F. A. Konzelman, manager of the company, is well known in engineering circles in the vicinity of Buffalo. The Brooks-Fisher Co., Candler building, Atlanta, Ga., has been appointed southeastern representative of the comapny. The latter is a new company.

Electric Auto Lite Corp., Willys Light Division, Toledo, O., has equipped an entire building as a school for service and sales training on plans formulated by Walter H. Roberts, general sales manager of the company. It is planned to have all the members of the sales organization of 2500 dealers, 85 distributors and several hundred service men go through the school work. The work will be in active charge of M. A. Duquette and Frank Sweigart, both of whom are well-trained in industrial school work.

De Laval Steam Turbine Co., Trenton, N. J., has issued a pamphlet entitled "High Efficiency Centrifugal Pumps" in which is described official tests made by the city of Minneapolis upon a 20-in. De Laval centrifugal pump driven by an induction motor and similiar tests made by the city of St. Paul upon two 12-in. De Laval centrifugal pumps driven by synchronous motors. The Minneapolis pump, which discharges 30,000,000 gals. per day against a head of 251.56 ft. showed an efficiency of pump and motor of approximately 82½% and a pump efficiency of 86%. The smaller St. Paul units, pumping against heads up to 185 ft. showed over-all efficiency cies, including pump and motor of 78 and 78.4% respectively and pump efficiencies of 81.8 and 82.2%. The pamphlet will interest all persons concerned with the handling of water by electric power.

Westinghouse Electric & Manufacturing Co. has contracted with the Westinghouse, Church, Kerr & Co., to build four new buildings at South Philadelphia, Pa. The expansion is intended to take care of the immediate needs incidental to the removal of the machine works (formerly the Westinghouse Machine Co.) from East Pittsburgh, Pa. The building will include a light machine shop, one story, 500 by 130 ft., to be used for building small turbines for operating pumps and generators; machine shop No. 3, 750 by 130 ft.; for machining of steam turbines; the erecting shop will be extended 300 ft.; a three-story building, 600 by 50 ft., will be constructed to provide warehouse facilities, the third floor of the building to be used for manufacturing purposes. Nearly all of the machinery necessary for production purposes will be transferred from the machine works, East Pittsburgh, and will be directly driven by motors, thus eliminating all overhead shafting.

Benjamin Electric Manufacturing Co., Chicago, has published a book on industrial lighting that embodies much practical information for applying the principles laid down by illuminating engineers as the best practice in the lighting of buildings and areas devoted to industrial uses. The book has been prepared with a view of being helpful to anyone interested in obtaining correct industrial lighting. There is a chapter on general illuminating information with tables and definitions which reduce to simple terms the complex formula out of which correct deductions with regard to the specification of lamps and fixtures are received. There is a table giving the foot-candle intensities desirable as worked out from a consensus of the best opinions of illuminating engineers and physicists, and a complete presentation of the electrical symbols used on architect's drawings. Numerous examples of industrial lighting requirements with actual photographic reproductions of results, add greatly to the usefulness of this practical book on lighting requirements.

Wheeler Condenser & Engineering Co., Carteret, N. J., announces the publication of the 1920 edition of its "Steam Tables for Condenser Work." This is the fifth edition. The book gives the properties of saturated steam from 29.8 in. vacuum to atmospheric pressure in increments of tenths of an inch. The vacuum in inches of mercury is referred to a 30-in. barometer. This method is superior to the old method of giving absolute pressures in pounds per square inch, since it is customary to read vacuum in inches of mercury. A complete table is also given of the properties of saturated steam above atmospheric pressure. The book tells how to make measurements by means of the mercury column and barometer. It gives constant and tables for making corrections. It gives the correction to be made for relative expansion of mercury and brass scale, ect. The book is made in pocket size.

Apex Electrical Distributing Co., Cleveland, O., has issued the "Electric Cleaner Sales Guide," called by the company the "How-To" book for Apex dealers and salesmen, that is about as neat a piece of literature in the way of an advertising booklet that has been put out in some time. There is nothing dry about the sales guide. It is brief and pithy and tells salesmen and dealers just how to reach and sell prospective customers and a mass of other information all told in an interesting and readable way. Covered in the booklet are the following points: window trimming, store displays, telephone attachments, educating salesmen, pay of salesmen, getting "leads" for new men, advertising in newspapers, making sales by letters, advertising in moving picture theaters and, under "selling instructions," canvassing for home sales, impressing the house wife, making the demonstration, presenting Apex selling points, closing the sale and overcoming arguments. Copies of the booklet will be sent to dealers on request.

Coast Equipment Co., with offices in the Merchants Exchange building, San Francisco, and the San Fernando building, Los Angeles, has been appointed exclusive sales agents for California and Nevada for the following companies: Ridgway Dynamo & Engine Co., Ridgway, Pa., manufacturing turbogenerator sets, alternating and direct-current generators, motor-generator sets, steam-engines, synchronous motors; Pittsburgh Transformer Co., Pittsburgh, Pa., transformers; the Atlas Car & Manufacturing Co., Cleveland, O., electric storage-battery and trolley locomotives, storage battery, flat-cars and industrial cars; Norwalk Iron Works Co., South Norwalk, Conn., air, oxygen, hydrogen and carbonic-acid gas compressors, and automatic ammonia compressors; Duncan Electric Mfg. Co., Lafayette, Ind., watt-hour meters.

PERSONAL MENTION

Biographical Sketches and Chronicle of Changes in Business Connections, Promotions and Other Personal News of the Industry

SAMUEL S. WALES, chief electrical engineer of the Carnegie Steel Co., has been elected a director of the Electric Alloy Steel Co., Youngstown, O.

J. G. MILES has been appointed supply division manager of the Westinghouse Electric & Manufacturing Co., at Seattle, Wash., succeeding C. V. ASPINWALL.

EDWARD C. JONES, chief engineer of the gas department of the Pacific Gas & Electric Co. since 1891, has resigned to go into business for himself in San Francisco.

DAVID J. JENKINS, formerly junior fuel engineer of the United States Bureau of Mines, Pittsburgh, Pa., has become associated with the Dallas Power & Light Co., Dallas, Tex.

THOMAS H. MACCAULEY, manager of the Calgary, Can., municipal railway since 1909, has resigned to become general manager of the New Brunswick Power Co.

PAUL CALDWELL has resigned as sales manager in New York for the Cleveland Crane & Engineering Co., Wickliffe, O., to re-enter the employ of the General Electric Co.

W. W. WILLIAMSON, formerly sales manager of the Alpha Electric Co., 151 West 30th street, New York City, has been made general manager to succeed JAMES H. HUGHES, recently resigned.

GEORGE M. CULLINANE is now sales engineer in the St. Louis branch office of the Westinghouse Electric & Manufacturing Co., having resigned as sales manager of the Scullin Steel Co., St. Louis.

FRANK R. TOWLES, formerly general superintendent of the York County Light & Power Co., has resigned to become superintendent of the Cumberland County Power & Light Co., at Portland, Me.

JAMES E. ALLISON, president of James E. Allison & Co., consulting engineers, addressed the St. Louis (Mo.) Electrical Board of Trade, March 12, on "Valuation of Public Utilities," at a luncheon at the Hotel Statler.

WALTER NEUMULLER, recently appointed secretary of the New York Edison Co., has been with the company since 1900. He is an active worker in a number of electrical organizations including the National Electric Light Association.

RICHARD H. RICE, acting manager of the Lynn, Mass., works of the General Electric Co., has been appointed manager of the Lynn plant, succeeding WALTER C. FISH. Mr. Rice is a member of the American Society of Electrical Engineers and has contributed to a number of technical publications.

C. G. SCHAEFER, for the past 10 years local sales and application engineer for the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., has been appointed district manager of a new branch office opened by the Standard Electric & Elevator Co., at Baltimore, Md.

F. H. SCHEEL has been made manager of the investment departments of the Commonwealth Edison Co. and the Public Service Co. of Northern Illinois. The appointment became effective Feb. 1. There is no connection between the two departments, except for the joint office under Mr. Scheel's direction. Prior to taking up this work Mr. Scheel was division superintendent of the Public Service Co. of Northern Illinois at Joliet, and previous to that had acted as contract agent in the territory south of the city of Chicago with headquarters at Joliet. He has also acted as chairman of the Residence Lighting Committee of the Lighting Sales Bureau of the National Electric Light Association, and is active as a member of several other committees.

F. H. Scheel.

MARCUS GROSSMAN, graduate of the Massachusetts Institute of Technology, has been appointed chief metallurgist of the Electric Steel Alloy Co., Youngstown, O. Mr. Grossman leaves the Westinghouse Electric & Manufacturing Co., Pittsburgh, to take up his new work.

E. M. HERR, president of the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., was chairman of the Ecuador group at the second Pan-American financial conference, recently held at Washington.

JOHN D. CRAWFORD has become associated with the Wellman-Seaver-Morgan Co., Cleveland, O., in an engineering capacity. He was formerly consulting engineer, in charge of research and development, for the Maryland Pressed Steel Co., Hagerstown, Md.

LESTER W. GILL, formerly professor of electrical engineering at Queen's University, Kingston, Ont., is now director of technical education for the Canadian Department of Labor at Ottawa, Can.

FRANK O. WELLS, president of the Greenfield Tap & Die Corp., Greenfield, Mass., has sold his entire holdings in the corporation to FREDERICK H. PAYNE, vice president. Mr. Wells retires as president and member of the board of directors and Mr. Payne has been elected president. FRANCIS G. ECHOLS, vice president and general manager, has been elected a director of the corporation. Mr. Wells is to remain with the corporation in an advisory capacity.

JAMES T. HUTCHINGS, president of the Rochester Gas & Electric Corp., Rochester, N. Y., gave an interesting talk on "Central Station Operation During and After the War," at the monthly meeting of the Rochester Engineering Society. Mr. Hutchings is to resign his connection with the Rochester Gas & Electric Corporation effective April 1, to become assistant manager of the United Gas Improvement Corporation, Philadelphia.

OBITUARY.

JAMES M. SMYTH, Astoria, L. I., formerly connected with the Golden Stock Telephone Company, one of the original telephone concerns, and later with the Knickerbocker and New York Telephone Companies, died on March 8, at the Roosevelt Hospital.

JAMES J. FLANNERY, organizer of the former American Vanadium Co. and its head until the company was taken over by the Vanadium Corp. of America, died March 7, at Pittsburgh. He was 66 years old.

C. T. JOHNSTON, mechanical and electrical engineer, died at his home in St. Paul, Feb. 25, after a brief illness. Mr. Johnston was a graduate of the Massachusetts Institute of Technology, class of 1909. At the time of his death he was associated with his father, C. H. Johnston, architect, having entire charge of the electrical, heating and ventilating engineering work in the latter's office.

EDWARD VINTON HAINES, aged 40 years, general auditor of the Indianapolis Telephone Co. and its subsidiary companies, for the past 12 years, died March 1 of cerebral hemorrhage, at Toledo, O. Mr. Haines went from his home in Indianapolis to Toledo January 1 to become sales manager for the Woolson Spice Co. He was in excellent health up to a few days before his death.

BUSINESS OPPORTUNITIES

News of Electrical Construction Projects in All Parts of the Country, Proposals Invited, Foreign Trade Openings and New Companies

EASTERN STATES.

Waterville, Me.—Waterville Manufacturing Co., plans to build a 1 and 2-story addition about 80 by 300 ft. to its plant. The additions will be of reinforced concrete construction and will cost about $125,000. Green & Wilson, 74 Main street, Waterville, Me., are the engineers.

Somersworth, N. H.—Great Falls Manufacturing Co. has had plans prepared for a 4-story reinforced construction mill, 144 by 1850 ft., to cost about $4,500,000. Lockwood, Greene Co., Brewer building, Boston, Mass., are architects and engineers for the company.

Boston, Mass.—Harris-Forbes Co., 35 Federal street, will build 11-story bank and office building at Federal and Congress streets, at a cost of about $4,000,000. The building will be owned by the Boston Chamber of Commerce.

Manchester, Mass.—Town will build a memorial hall at a cost of $70,000. E. F. McKnight is chairman of Memorial Committee.

Springfield, Mass.—United Electric Light Co. is understood to be arranging plans for the construction of new electric substations at Carew and North streets, as well as for the installation of new turbines and other equipment, for increased operations. The company is considering an increase in its capital from $2,400,000 to $3,200,000, to provide for the proposed expansion.

Springfield, Mass.—New England Westinghouse Co. has completed negotiations for the purchase of a tract of about eight acres of land adjoining its work at East Springfield, for future expansion.

Bridgeport, Conn.—United Illuminating Co., 115 Broad street, has awarded a contract to the C. W. Blakeslee & Sons Co., 58 Waverly street, New Haven, for the construction of a large new power station to be located on Pembroke street. It is said that the new plant, when completed, will cost close to $3,000,000, including machinery and equipment installation.

Bridgeport, Conn. — Maloney & Krokstedt, architects, 925 Main street, are preparing plans for a 6-story brick and reinforced concrete hotel, to cost $300,000.

Hartford, Conn.—Yokel Corp., recently organized, has acquired property on Homestead avenue, as a site for the construction of a new plant to be devoted to the manufacture of lighting fixtures, etc.

New London, Conn.—United States Electric Co. is understood to have acquired property at Springfield, Mass., for the establishment of a new local plant, details of which are now being arranged.

Buffalo, N. Y.—Bureau of Yards & Docks, United States Government, has awarded a contract to W. F. Martels, Cutler building, Rochester, N. Y., for the construction of the proposed new local radio building at the Government site.

Central Islip, N. Y.—State Hospital Commission, E. S. Elwood, secretary, has had plans prepared for the installation of a new electrically-operated fire-alarm system throughout the Central Islip State hospital. Lewis F. Pilcher, State capitol, Albany, is architect.

Cheektowaga, N. Y.—Depew & Lancaster Light, Power & Conduit Co. has filed notice with the Secretary of State of an increase in its capitalization from $500,000 to $1,250,000.

Hadley, N. Y.—Hadley Light & Power Co., Inc., is considering plans for the construction of a new addition to its local electric light and power plant.

Jamaica, L. I., N. Y.—Dictograph Co., Beaufort street, manufacturer of electrically-operated devices, has awarded a contract to the Barney-Ahlers Construction Co., 110 West 40th street, New York, for the construction of a 1-story reinforced concrete addition, 50 by 144 ft.; for increased capacity.

Leroy, N. Y.—Lapp Insulator Co. has filed notice with the Secretary of State of an increase in its capitalization from $150,000 to $500,000.

Lockport, N. Y.—In connection with the proposed new addition to the City hospital, estimated to cost about $60,000, it is understood that considerable electrical equipment will be required.

Long Island City, N. Y.—Astoria Light, Heat & Power Co., Shore road, has had plans prepared for the construction of new fuel-oil tanks at Winthrop avenue and Crescent street, to facilitate operations. The work is estimated to cost $80,000. The company recently arranged for the construction of a new addition at Van Alst and Winthrop avenues, to cost about $150,000.

New York, N. Y.—In connection with the order recently issued by the Public Service Commission to the Interborough Rapid Transit Co., covering increased and improved service over its subway system, plans are being arranged by the company for the purchase of considerable new rolling stock.

New York, N. Y.—T. S. Buffum & Co., 52 Broadway, has had plans prepared for the installation of a new boiler plant in connection with alterations and improvements at their building at 27 Pearl street, estimated to cost about $50,000.

New York, N. Y.—Habirshaw Electric Cable Co., 10 East 43rd street, manufacturer of insulated wire and cable, with works at Yonkers, has filed articles of incorporation under Delaware laws with a capital of $31,350,000.

New York, N. Y.—Westinghouse Electric International Co., a Delaware incorporation, has filed notice of authorization to operate in New York with a capital of $100,000. B. W. Kilburn, 165 Broadway, has been appointed to act as local representative.

New York, N. Y.—Standard Oil Co. has had plans prepared for the installation of eight new elevators of the traction type in its 15-story building at 26 Broadway, the work being estimated to cost in excess of $500,000.

New York, N. Y. — Automatic Straight Air Brake Co., 14 Wall street, a Delaware incorporation, has filed notice with the Secretary of State of an increase in its capital from $22,000,000 to $32,000,000.

Niagara Falls, N. Y.—National Carbon Co., manufacturer of carbon products, has awarded a contract to John W. Cowper, Inc., Fidelity building, Buffalo, for the construction of a new furnace building at its plant, for increased operations. The structure will be 1-story, brick and steel type, about 85 by 320 ft., and is estimated to cost $150,000, including equipment.

Rome, N. Y.—Rome Wire Co., manufacturer of insulated electrical wire products, etc., has completed arrangements for the issuance of stock for $1,400,000, a portion of the proceeds to be used, it is understood, in connection with the establishment of a new works at Buffalo, N. Y. H. T. Dyett is president.

Rome, N. Y.—Fire recently destroyed the municipal pumping station and damaged machinery and equipment in the power plant, with loss estimated at about $20,000.

Tuckahoe, N. Y.—Hodgman Rubber Co. is having plans prepared for the construction of a new power plant to be used for the operation of its proposed new 6-story plant on Scarsdale avenue, about 80 by 150 ft. The plant will be of reinforced concrete type.

Walden, N. Y.—Walkill Valley Electric Light & Power Co. has increased its capital from $30,000 to $50,000 for business expansion.

Bayonne, N. J. — International Nickel Co., Constable Hook district, has had plans prepared for the construction of a new pumping plant at its works. The structure, including machinery and equipment, is estimated to cost about $40,000.

Bloomfield, N. J.—Westinghouse Lamp Co., 165 Broadway, New York

City, has had plans prepared for the construction of a new 4-story reinforced concrete manufacturing building, to be located at its properties in the Watsessing district of Bloomfield. The structure will be about 80 by 550 ft., and when completed is estimated to cost about $1,000,000, including machinery and equipment. Westinghouse, Church, Kerr Co., 37 Wall street, New York City, are engineers.

Essex Fells, N. J.—Central & South American Telegraph Co., 89 Broad street, New York City, is understood to be arranging plans for the establishment of a local plant, to be devoted to the manufacture and repair of cable instruments.

Harrison, N. J.—Driver-Harris Wire Co., Middlesex avenue, manufacturer of electrical wire, has awarded a contract to the John W. Ferguson Co., Paterson, N. J., for the construction of the proposed new 6-story factory building at its plant, about 60 by 100 ft.

Jersey City, N. J.—Continental Can Co. has awarded a contract to Grange & Sloan, 527 Fifth avenue, New York City, for the construction of its proposed new 4-story reinforced concrete plant to be located at Fifteenth, Sixteenth, Cole and Monmouth streets, estimated to cost approximately $750,000. Included in the plans is the erection of a new power plant for general factory operation.

Jersey City, N. J.—Whitlock Cordage Co., Communipaw avenue, has had plans prepared for the construction of a new power plant, about 20 by 54 ft., in connection with the erection of a 4-story plant addition of reinforced concrete construction. The machinery installation will comprise turbines, a battery of four new 400-hp. boilers, and auxiliary equipment.

Newark, N. J.—Beller Electric Supply Co. has completed negotiations for the leasing of the 2-story building at 28 Treat place, for a new establishment. Robert Beller, Trenton, N. J., heads the company.

Pennington, N. J.—Fire, on February 26, destroyed a portion of the main building at the plant of the Peerless Insulated Wire & Cable Co., Franklin street, with loss estimated at about $5,000. It is understood that the company is planning for immediate rebuilding.

Roosevelt, N. J.—Fire, March 9, caused by a boiler explosion, destroyed the local plant of the Carteret Oil Refining Co., with loss estimated at approximately $250,000.

Trenton, N. J.—Crescent Insulated Wire & Cable Co., Olden avenue and Taylor street, has awarded contracts for the erection of an addition to its plant, about 50 by 150 ft. Edward Murray is president.

Wilmington, Del. — Operations at the Brandywine power plant have been suspended temporarily due to severe flood conditions in this section.

Bangor, Pa.—Bangor Electric Co. is understood to be arranging plans for increased operations in its local electric plant and system.

Blossberg, Pa.—Board of Managers of the Blossberg hospital is taking bids for the construction of the proposed new 1-story power plant and laundry building at the institution. The structure is estimated to cost about $20,000.

Chester, Pa. — Considerable electrical equipment, refrigerating and heating apparatus will be required in connection with the construction of the proposed new surgical building at the Chester hospital, Ballinger & Perrot, Philadelphia, are architects.

Clearfield, Pa.—In connection with the expansion plans of the Penn Public Service corporation, plans are being arranged to increase the generating capacity of its plant at Rockwood. Plans are in process of formation for the organization of a subsidiary company which proposes to purchase a large tract of property near Seward, Pa., to be utilized as a site for the construction of a new power station. It is proposed to have the initial plant of 30,000-kw.. capacity, with arrangements for an ultimate output of approximately 80,000 kw. The Penn company operates a total of nine generating plants having an installed generating capacity of 33,412 kw., with electrical distributing system comprising approximately 2527 miles of aerial wire in addition to an underground system at Johnstown containing 149,418 duct ft. of conduit. The company recently issued bonds for $4,000,000, the proceeds to be used for the extensions and expansion work.

Erie, Pa.—Skinner Engine Company, Twelfth and Chestnut streets, is having plans prepared for additions and improvements in its plant for increased operations. The proposed work will include the erection of a new 1-story power plant, 65 by 100 ft., 1-story shop building, 60 by 270 ft., and alterations and improvements in the existing works. The project is estimated to cost about $80,000. A. F. Shotte, Marine Bank building, Erie, is engineer.

Philadelphia, Pa. — Philadelphia Electric Co. has purchased the 4-story building at 52 North 6th street.

Philadelphia, Pa.—Electric Storage Battery Co., Nineteenth and Allegheny streets, has completed negotiations for the purchase of a tract of about 40 acres of property. The company is planning to utilize the site for the enlargement of its plant for increased production.

Philadelphia, Pa.—Rumsey Electric Co., 1007 Arch street, has awarded a contract to the John Baizley Iron Works, 514 South Delaware avenue, for alterations and improvements in its plant, to facilitate operations.

Pittsburgh, Pa. — Westinghouse Union Battery Co., recently organized, is arranging for the operation of its plant for the manufacture of electric batteries. The company occupies three entire floors in the plant of the Union Switch & Signal Co., Swissvale, and will give employment to about 500 persons. It is understood that plans are under consideration for the construction of a new plant adjoining the Swissvale works of the Union company, to have an initial capacity of about 1,200 batteries daily.

Pittsburgh, Pa. — Union Electric Steel Co. has filed notice with the Secretary of State of an increase in its capital from $350,000 to $3,000,000.

Reading Pa. — City is considering plans for alterations and improvements in the Maiden Creek pumping station of the municipal waterworks plant, for increased operations. D. E. Dampman is superintent of parks and public property.

Baltimore, Md.—Following the reports recently current that plans were under consideration for the electrification of a portion of its lines, President Willard, of the Baltimore & Ohio Railroad Co. has issued a statement denying that any such work was under contemplation.

Baltimore, Md.—In connection with the construction of the proposed new administration building and printing plant of the Maryland Casualty Co. to be located on the Dulin tract at 40th street and Cedar avenue, estimated to cost about $1,500,000, considerable electrical and mechanical equipment will be required, including motors for individual drive. Arrangements are being completed for the construction of the initial units of the plant, to cost $175,000, to include printing shop and boiler room buildings, each 2-story and basement, 60 by 122 ft. and 65 by 104 ft., respectively, as well as a garage and repair shop, about 60 by 122 ft.

Baltimore, Md.—M. S. Levy & Sons, South Paca street, manufacturers of straw hats, have completed negotiations for the purchase of property at 111 South Paca street, with 3-story building. The company plans the conversion of the structure into a large boiler plant and engine house to be used in connection with its plant operation.

Baltimore, Md.—Columbia Graphophone Co., Bridgeport, Conn., is having plans prepared for the construction of the initial units of its proposed new local plant to be located in the Orangeville district, estimated to cost approximately $1,000,000 when completed. The works will include the construction of a number of manufacturing buildings, machine shops, record plant, addition to existing cabinet plant, and a large power plant for general works operation. Considerable electrical and mechanical equipment will also be required.

Westport, Md.—Consolidated Gas, Electric Light and Power Co. will erect a $60,000 building. The structure is to be of steel, concrete and brick construction.

Norfolk, Va.—Virginia Ice & Freezing Corp. has awarded a contract to the Erwin Leslie Co., McKevitt building, Norfolk, for the construction of a new ice cream manufacturing and cold storage plant, 1-story, about 76 by 100 ft., at Ocean View, Va., estimated to cost $150,000. Considerable electrical equipment and refrigerating apparatus will be required at the new works. J. C. Prince is president.

Keyser, W. Va.—Keyser electric light plant has been acquired by new interests. The new owner is planning to continue the operation of the plant, the company to be known as the Keyser Electric Co.

Kinston, N. C.—City has had plans prepared for the construction of a new municipal electric light plant, estimated to cost about $30,000. Complete equipment for all features of operation will be installed, including turbine, boiler equipment and auxiliary apparatus. W. C. Olsen is engineer.

Estill, S. C.—City Commissioners are considering plans for the construction of a new 1-story brick electric light plant, for municipal service. The structure will be about 35 by 50 ft. James Howe is chairman of the commission.

Homerville, Ga.—City has approved the issuance of bonds for $10,000, to provide for the installation of a new electric light plant for municipal service.

Lyerly, Ga.—Plans are being prepared by the City Council for the early installation of a new electric street-lighting system.

Smithville, Ga.—Atlanta engineers are drawing preliminary plans for municipal electric lighting system. Address mayor.

NORTH CENTRAL STATES.

Akron, O.—Sieberling Hotel Co., is having preliminary plans prepared by G. B. Post & Sons, architects, 1109 Schofield building, Cleveland, O., for a 20-story reinforced concrete, brick and steel hotel and theater, to cost $5,000,000.

Ashtabula, O.—City Manager will secure specifications for enlarging the electric light plant. Address mayor.

Canton, O.—T. C. Smith is having plans prepared by Albrecht-Wilhelm & Kelly, architects, Union building, Cleveland, O., for a 1-story, reinforced concrete, brick and steel garage, 66 by 200 ft. to cost $50,000.

Cincinnati O.—Davis Welding Co., 1543 Queen City avenue, plans to build a factory on Borden street, at a cost of about $150,000.

Cleveland, O.—Beckman Co., 3167 Fulton road, will build a 2-story reinforced concrete brick and steel weaving factory, 200 by 200 ft., at a cost of $400,000. Lockwood-Green & Co., Bangor building, Cleveland, are architects and engineers.

Cleveland, O.—Electric Steel and Forge Co. has placed in operation its new hammer shop which is equipped with a 6-ton, two 2500-lb., two 1500-lb., one 800-lb. and one 600-lb. steam hammers. When present plant extensions are completed the equipment will also include two 6-ton and one 1000-lb. electric furnaces, one of the larger furnaces already being in operation.

Findlay, O.—Findlay Market Improvement Association is interested in improving electric lighting conditions in certain streets. Address mayor.

Franklin, O.—The V. & D. Electric Co. will build a 3-story brick building adjoining its present quarters in order to care for increased business.

Marion, O.—The Columbus, Delaware & Marion Electric Co. is to make extensive improvements. The power plant to be erected at Newmans is to cost $1,000,000 and the central offices in Marion between $250,000 and $500,000. All the contemplated improvements are to be completed in two years, the work starting this spring.

Youngstown, O.—The Electrical Alloy Steel Co. has increased its capital stock to $3,000,000. Heavy subscriptions to the stock were made by industrial leaders in the Youngstown district.

Connersville, Ind. — The Hydro Electric Light & Power Co. has increased its capital from $75,000 to $1,125,000.

Connersville, Ind. — The Waignwright Engineering Corp. has increased its capital stock from $200,000 to $750,000.

Evansville, Ind.—Liquid Carbonic Co., Heidelback avenue and Water street will build a 2-story brick factory, 75 by 150 ft. to cost $50,000. C. Shopwell & Co., Furniture building, Evansville, are architects.

Gary, Ind.—National Tube Co. will build a mill to cost $40,000,000 and give employment to 10,000 men. Work has already started on the construction of four large blast furnaces, to be followed by the erection of tube mills, shops, office buildings and other structures required for the plant.

Indianapolis, Ind.—Dean Brothers Steam Pump Works will build two additions to its plant, 27 by 130 ft. and 50 by 125 ft., respectively, the extensions to cost about $50,000.

Indianapolis, Ind.—The Interstate Public Service Co. has increased its capital stock from $5,500,000 to $8,000,000.

Kendallville, Ind.—The Kendallville Foundry Co. is taking bids for a 1-story addition, to cost about $30,000.

Kokomo, Ind.—The International Engineering & Manufacturing Co. will establish a plant at an estimated cost of $100,000 for the manufacture of power plants, etc.

Kokomo, Ind.—Kokomo Specialties Manufacturing Co. has increased its capital stock from $10,000 to $50,000.

Muncie, Ind.—Big Four railroad will erect freight house, 42 by 262 ft., to cost $100,000.

Richmond, Ind.—A bond issue of $200,000 will be recommended to the city council by the board of public works to enable the municipal lighting plant to purchase equipment. Fully 90% of the industrial plants of Richmond are dependent on the plant for power. The new equipment will include a 5000-kw. turbine, a condenser, motor-generator set and other apparatus, estimated to cost $50,000.

Terre Haute, Ind.—The Columbian Enamelling & Stamping Co. has awarded a contract to Raehn Brothers, Terre Haute, for a 1-story addition to its plant, 155 by 240 ft., to cost about $50,000.

Carlinville, Ill.—The Carlinville National bank has awarded the contract to the St. Louis Bank Equipment Co. for its new building which will cost $25,000.

Peoria, Ill.—The Automatic Carbonic Machine Co. has certified to an increase in capital stock from $15,000 to $200,000.

Chicago, Ill.—The D. O. James Manufacturing Co., 1120 West Monroe street, gear cutters, will build a 3-story annex, 48 by 120 ft., to its present plant.

Chicago, Ill.—Steel Sales Corp., 129 South Jefferson street, will build a 1-story plant, 400 to 600 ft. on Crawford avenue and 35th street, at a cost of $250,000.

Chicago, Ill.—The Power Equipment Co. 343 South Dearborn street, will build a 1-story plant 124 by 150 ft., to cost $75,000.

Chicago, Ill.—Contract has been awarded by the Stewart Warner Speedometer Co. for the erection of a 6-story plant, 141 by 150 ft., to cost $400,000.

Chicago, Ill.—The Dole Valve Co., 208 Wells street, has awarded a contract for a 2-story plant, 100 by 123 ft., to cost $90,000.

Chicago, Ill.—The Woodford Engineering Co., 118 North La Salle street, plans a 2-story machine shop, 144 by 122 ft., to cost $75,000.

Danville, Ill.—A boulevard lighting system for the down-town business district was favorably acted upon by the board of local improvements. The city engineer has been authorized to prepare plans. Estimated cost is $38,000.

Decatur, Ill.—The Comet Automobile Co. contemplates a 4-story plant addition.

Geneva, Ill.—Bonds have been voted for the purpose of improving the village power plant. Address village clerk.

Detroit, Mich.—The Superior Machine & Engineering Co., 51 East Fort street, has received bids for a new story plant, 100 by 120 ft., on East Larned street, to cost about $100,000. Brown & Preston, 406 Empire building, are architects.

Detroit, Mich.—The Detroit Belt Lacer Co., 27 A street, has completed plans for a new 2-story plant, 60 by 100 ft., to cost about $35,000.

Detroit, Mich.—Hall Lamp Co. will erect a factory and office addition.

Detroit, Mich.—Hupp Motor Car Co. has five 4-story factory units in course of construction.

Detroit, Mich.—The Russell Motor Axle Co. contemplates the erection of a 1-story, heat-treating building, 35 by 60 ft.

Marysville, Mich. — The Village Board is planning ways and means to light the village streets. Address Edward Clement, village manager.

St. Joseph, Mich.—The Upton Machine Co. is having plans prepared for a 1-story machine shop, 90 by 175 ft., to cost about $50,000.

Kenosha, Wis.—The Nash Motors Co. has placed contracts for a factory building to be equipped for manufacturing open and closed bodies. The building will be 400 by 1200 ft.

Manitowoc, Wis. — Wisconsin Aluminum Products Co., 16th and Franklin streets, will build a 4-story,

reinforced concrete, brick and steel factory, 60 by 250 ft., to cost $250,000.

Marinette, Wis. — The Montana Tractor Co. is reported to be planning to build a plant near Marinette, the plant to be 175 by 250 ft., costing $40,000.

Milwaukee, Wis. — The Nordberg Manufacturing Co. plans a machine shop addition 2-story high, 60 by 112 ft., to cost $60,000.

Milwaukee, Wis.—The H. W. Johns-Manville Co., 201 Clybourn street, has awarded a contract for a new plant.

Montevideo, Minn.—The city pumping station has installed a 75-hp. motor, which makes a total of 95 hp. being furnished the plant by the Montevideo division of the Northern States Power Co.

St. Paul, Minn.—A local publishing company has placed in service 44 electrically heated linotype pots, having a total capacity of 65 kw. This installation replaces gas-heated equipment.

Davenport, Iowa—The Berle Manufacturing Co. will expend between $25,000 and $30,000 on rehabilitation of its Davenport plant.

Davenport, Iowa.—White Lily Manufacturing Co. has increased its capital stock from $60,000 to $600,000.

Lundgren, Ia. — A new lighting, heating and power plant with a capital of $12,500 has been organized here. Clarence B. Price, is president.

St. Louis, Mo.—Lehmann Machine Co., 606 South Broadway, will build a 2-story brick and terra cotta factory, monitor type, 110 by 195 ft., to cost $450,000.

Windsor, Mo.—Windsor Light & Power Co. contemplates changing its plant to alternating current and extending transmission lines. Address R. F. Williams, secretary.

Alden, Kan.—Alden has voted $10,000 for improvements to its light plant and Wetmore is considering the expenditure of an equal amount. Five cities, Coats, Louisburg, Sawyer, Paola and Haven are all considering calling elections to vote bonds either for the erection of new plants or the purchase of privately-owned plants.

Belpre, Kans.—The Pawnee Power and Water Co. has been authorized to issue $37,250 capital stock for improvements.

Great Bend, Kan.—E, A. Brown & Co., Kansas City, Mo., are installing a white way on Kansas avenue and the south half of Main street.

Rosendale, Kan.—Cleveland Steel Barrel Co., 9612 Meech avenue, Cleveland, O., will build 1 and 2-story factory building, 80 by 290 ft. and 45 by 80 ft., respectively. The buildings will be reinforced concrete, brick, steel and stone construction and cost $80,000. Brostrom and Drotts, 400 Reliance building, Kansas City, Mo., are architects.

Chisholm, Minn.—Expenditure of approximately $150,000 for the enlargement of the main generating plant of the Minnesota Utilities Co. has been announced. A new 4000-hp. turbogenerator and several new boilers will be installed.

Blunt, S. D.—An election will be held to vote on the question of issuing bonds for the purchase of an electric lighting system and building of water works.

Mobridge, S. D.—The capacity of the Mobridge electric light plant will be doubled by the installation of more equipment during 1920.

Fargo, N. D.—Union Light, Heat & Power Co. had an exhibit at the Automobile and Home Products show recently held at Fargo.

SOUTH CENTRAL STATES.

Bowling Green, Ky.—Scottsville Utilities Co. is arranging plans for the construction of a new three-phase high-tension transmission line, to extend about 25 miles, in the Bowling Green district. J. S. Braswell, Scottsville, is in charge of the work.

Paducah, Ky.—Extensive improvements, which will cost $250,000, are contemplated by the Paducah Electric Co. and the Paducah Railway Co. The work will mean expansion of the present plant and improvement in facilities of the gas manufacturing plant and the reconstruction of Paducah's system of street car lines. The estimated cost is $175,000.

Ripley, Tenn.—Town Council has had plans prepared for extensive alterations and improvements in the municipal electric lighting plant, for increased operations. C. H. Jenks, Union City, Tenn., is engineer.

Anniston, Ala. — Alabama Power Co. will improve and enlarge its power system in this district.

Banks, Ala.—The town will install electric lighting system. Address mayor.

Clinton, Ala.—The Alabama Power Co. has purchased the stock and plant of the Wade Electric Lighting & Power Co.

Selma, Ala.—Purity Ice & Creamery Co. plans to build ice plant, creamery and ice cream manufacturing plant. S. F. Hobbs is president.

Friars Point, Miss.—Friars Point Light, Water & Ice Co. will erect a power plant and install $18,000 worth of machinery. Minor C. Lyon is proprietor.

New Orleans, La.—Go Ro Co., Inc., 826 Baronne street, plans to build a 1-story brick and steel construction factory, 110 by 328 ft., at a cost of $75,000. N. G. Goreau, 826 Baronne street is the engineer.

Magnolia, Ark.—Consumers' Ice & Light Co. has organized and has purchased the Arkansas Light & Power Co.'s plant, including 15 miles of wire and poles and transmission lines to McNeill and Waldo. The new company will rebuild the plant and install machinery.

Claremore, Okla.—H. F. Sprangel, manager of electric light and water department will install a 312-kw.-a. generating unit in electric lighting plant.

Collinsville, Okla.—Plans are being prepared by the city commissioners for extensions in the municipal electric light plant and waterworks system. It is proposed to issue bonds for $135,000, the proceeds to be used for the additions and improvements as arranged. Johnson & Benham, Firestone building, Kansas City, Mo., are consulting engineers.

Enid, Okla.—New business added to the lines of the Enid division of Oklahoma Gas & Electric Co. includes 55 hp. in motors for the Enid Ice & Fuel Co., 63 hp. for the new plant of the Puritan Ice Co., 30 hp. for the St. Louis and San Francisco Railway shops and 25 hp. each for new grain elevators at Hennessey and Bison.

Denison, Tex.—Plans are under consideration by the city for the construction of a new electric street-lighting system. It is proposed to issue bonds for $224,000, a portion of the proceeds to cover the cost of this work.

Houston, Tex.—C. Bender & Sons, 617 Willow street, are having plans prepared for a 3-story warehouse to cost $70,000. C. D. Hill & Co., 315 Binz building, are architects.

Houston, Tex.—Baylor University is having plans prepared for a 1-story reinforced concrete and brick power house to cost $100,000. B. D. Eastwood, 405 Praetorian building, Waco, Tex., is architect.

WESTERN STATES.

Sandpoint, Ida.—A lumber company at Dalkena, Wash., is installing additional equipment requiring 255-hp. in motors. Electric energy is furnished by the Calispell Valley Light & Power Co., to which current is supplied on a wholesale basis by the Mountain States Power Co.

Tacoma, Wash.—Tacoma Railway & Power Co. has purchased six additional one-man street cars from the American Car Co., St. Louis, for which Westinghouse equipment has been adopted.

Enterprise, Ore.—The Enterprise Electric Co. has applied to the State Engineer for an appropriation of water on Wallowa river, and contemplates the installation of a hydroelectric plant.

Eugene, Ore.—Mutual Creamery Co. will build a factory 60 by 100 ft. at a cost of about $100,000.

Portland, Ore. — Bergman Shoe Manufacturing Co., 761 Thurman street, will build a 3-story concrete frame and heavy mill construction factory on 18th and Thurman streets. The building will be 60 by 100 ft. and cost about $50,000. Claussen & Claussen, architects, Macleay building, Portland, Ore., are receiving bids for the work.

El Centro, Cal.—The question of issuing ornamental-light and fire-alarm bonds is under consideration.

Hollywood, Cal.—It is proposed that bonds be voted for the installation of an ornamental post-lighting system here. H. T. Wright, secretary, Hollywood board of trade.

Los Angeles, Cal.—California Walnut Growers' Association, 1326 West Seventh street, is receiving bids for the construction of a 7-story reinforced concrete and brick construc-

tion warehouse, 100 by 150 ft., at 7th and Mill streets, to cost $175,000.

San Francisco, Cal.—P. J. Gartland, 21st and Guerero streets, will build a 3-story reinforced concrete and brick garage and salesroom at 11th and Market streets.

Torrance, Cal.—Torrance Packing Co. is having plans prepared for 1-story reinforced concrete and timber packing plant, 90 by 200 ft., to cost $50,000. E. H. Hortsman is architect.

Ukiah, Cal.—California Grape Products Co., plans to build brick and timber factory to cost $100,000.

CANADA.

Calgary, Alta.—J. F. McCall, city power house superintendent has recommended the purchase of a new motor generator at an approximate cost of $30,000.

Hamilton, Ont.—Plans are in progress for the erection of a theater to cost $1,000,000 for the Pantages Theater Co., George Stroud, manager, 10 Tisdale street. Thomas W. Lamb, 39 West Adelaide street is architect. Work on the theater is to start this spring.

London, Ont.—It is reported that the Canadian branch of the Gartley, Weston Co., Detroit, Mich., will be located at London. The company manufactures metal plating and will employ 500 men in the Canadian plant.

Montreal, Que.—Tenders will be called at once by the Civic Administrative Commission for two electric pumps of a capacity of 30,000,000 gals.

Regina, Sask.—Crane, Ltd., of Montreal, dealers in plumbing, heating and engineering supplies, have purchased a site and will erect a branch building in Regina.

Toronto, Ont. — Improvement of street lighting is to be made on a number of streets.

Toronto, Ont.—Firestone Tire & Rubber Co., 81 Adelaide West street, are receiving bids for the construction of a 4-story reinforced concrete and brick factory, to contain 350,000 sq.-ft. of floor space. The cost will be $350,000. H. Prack, 50 Bay street, is architect and engineer.

Toronto, Ont. — Canadian Lygard Engine Co. will build a plant for the manufacturers of carburetors, at a cost of $40,000. Walter W. Snelling, 66 Hiawatha road, Toronto, Ont., has the building contract.

Toronto, Ont. — Hydro-Electric Power Commission of Ontario has awarded a contract to the Canadian General Electric Co. for two generators of 52,000 hp. for the Chippewa-Queenstown power development. Two similar generators were ordered last year from another company and with the installation of the new equipment the commission will have a total initial installation of 200,000 hp. The power station is designed for a capacity of 450,000 hp. in nine units and one spare unit.

Saskatoon, Sask. — Canadian Fairbanks-Morse Co. will build warehouse, to cost about $75,000.

Vancouver, B. C.—Empress Manufacturing Co. will build a 3-story reinforced concrete building 32 by 30 ft. at 1106 Homer street at a cost of $20,000.

Victoria, B. C.—Canadian Electric Steel Products of New York plan to construct smelter and steel rolling mills at a cost of $5,000,000.

Winnipeg, Man.—Plans are in progress for the building of a theater to cost $600,000 for the Famous Players Canadian Corp. N. L. Nathanson, Temple building, Toronto, is managing director.

INCORPORATIONS

New York, N. Y.—Morganite Brush Co. Capital $200,000. To manufacture carbon brushes and kindred specialties. Incorporators: G. W. Edward, I. L. Anderson, and L. B. Donahue, 27 William street.

New York, N. Y.—Reliance Lighting Fixture Corp. Capital $20,000. To manufacture lighting fixtures for electric and gas service. Incorporators: J. Gottlieb and A. and M. H. Dworkin, 1115 Forest avenue, New York.

New York, N .Y.—Radio Communication Co. Active capital $51,500. To operate wireless telegraph systems. Incorporators: L. N. Haublum, S. H. Kaufman, and K. L. Zimmerman, 60 Wall street.

Brooklyn, N. Y.—Deluxe Lighting Fixture Corp. Capital $20,000. To manufacture electric and gas fixtures, etc. Incorporators: E. L. Silverman, L. J. Matlow and E. Lichtenberg, 113 West 114th street.

Jersey City, N. J.—Desmond Incandescent Lamp Co. Capital $50,000. To manufacture incandescent lamps and kindred specialties. Incorporators: William J., M. F., and G. M. Desmond.

Waynesburg, Pa. — International Electric Co. incorporated under Delaware laws. Capital $100,000. To manufacture electrical supplies. Incorporators: Harold Jackson, W. L. Jordan, Pittsburgh, and J. A. Hulings, Waynesburg.

Louisville, Ky. — Franklin Electric Co. Capital $50,000. To manufacture electrical goods. Incorporators: C. B. Ketchem, T. W. Voils, and W. G. Hesser.

Covington, Ky. — Kenton Electric Co., 6 West Pike street. Capital $10,000. To manufacture electrical appliances. Incorporators: Charlton Thompson, Hayard Thompson, and A. C. Johnson.

San Antonio, Tex.—Travis Electric Co. Capital $10,000. To operate a local electric light and power plant. Incorporators: J. E. Smith, Fred Krisch, and J. H. Cunningham, San Antonio.

Indianapolis, Ind. — Northwestern Machine Co. has been incorporated with capital of $5000 to do a general mechanical business.

Fort Wayne, Ind.—The Angell Appliance Co. has been incorporated with capital of $25,000 to deal in electrical supplies.

Anderson, Ind.—The Central Electric Co. has been incorporated with capital of $5000 for the installation of electric service. The incorporators are Lee Longfellow, Ray Thornsburg and Clyde Culbertson.

FOREIGN TRADE

[Addresses of firms referred to in these trade opportunities may be obtained by writing to the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its branch and local co-operative offices. Request for each opportunity should be on a separate sheet and the file number given.]

Electrical Goods (2242)—A firm in India desires to purchase and secure an agency for electrical goods, stationery, colors, varnishes, paints, glassware, and candles. Quotations should be given c. i. f. India port. Terms, cash with order. References.

Electric Machinery (31,847) — An engineer in Spain desires to secure agencies and purchase of all kinds of machinery for electric, hydraulic, metallurgic and chemical industries. Correspondence should be in Spanish, French, or Italian.

Electrical Heating and Cooking Apparatus (31,950)—A business man in Switzerland desires to purchase and secure an agency from manufacturers for electrical heating and cooking apparatus and accessories, all of the best quality. Quotations should be given c. i. f. destination. Payment 30 to 90 days through bank. Correspondence may be in English. Catalogues and price lists are requested to be in French or German. Reference.

Electrical Goods (32,004) — The commercial branch of a bank in Bulgaria, under the management of an engineer who was educated in the United States and familiar with American business methods, desires to be placed in touch with manufacturers or corporations desiring to promote trade with the Balkans. Catalogs, price lists and samples for exhibit in its showrooms are requested. It is also desired to get in touch with a leading bank desiring to establish commercial and baking operations.

Electrical Supplies (32215)—A merchant in Turkey desires to secure an agency for the sale of electrical supplies. Quotations should be given c. i. f. Turkish port. Payment, cash against documents. Reference.

Electrical Machinery (32083) — A former president of the Victorian Institute of Electrical Engineers in Australia, is anxious to make early connections with an American manufacturer who is able to participate in bidding on tenders soon to be called for by the Victorian Government, covering equipment for a high-tension project involving three turbo-generators of 25,000 kw., capacity for 130,000 volt, 50-cycle transmission, and the appliances and accessories required with such an installation. Reference.

NEED OF A LARGER POSTOFFICE AT CHICAGO

How the Country at Large Is Affected

Chicago has an "After the War" problem that concerns not only this city but also the entire country. The problem is the Postoffice building in Chicago, which is far too small to handle the volume of mail passing through it.

Under ordinary conditions lack of room, or congested conditions existing in a postoffice building, affect only the city or town in which the building is located.

But this is not true here; for Chicago is the great central market and distributing point for business east, west, north and south, and a crowded condition in the Chicago postoffice affects the trade of the entire middle section of the United States, as well as that of all other parts of the country with this section.

The policy of economy underlying the action of the House Appropriation Committee, in allowing no appropriation for public buildings or sites at this session, is a very laudable one; but the Chicago problem is so great that an exception should, and must, be made, because of the great emergency that exists.

It is not merely a matter of a public building for Chicago. It is the necessity for the erection of a new structure of suitable size in Chicago to handle the mails. Unless this is done, the mid-west postal situation will grow steadily worse, until it becomes a public scandal.

A few figures showing the congestion that exists in the Chicago postoffice are pertinent. The actual space available for the handling of incoming and outgoing mails is less than 200,000 square feet, situated in the basement and the first and second floors. The space available when the building was first occupied (1905-6) was 172,090 square feet; the yearly tonnage of mail was then 77,933 tons. The yearly tonnage in 1919 was 280,263 tons, and the floor space occupied 196,436 square feet, for separation, distribution and dispatch.

The exact figures of the increase in business of the Chicago postoffice since it first occupied the new building are shown in the following figures: Sale of stamps increased $25,898,892.95, or 211 per cent., while mail tonnage increased 206,068 tons, or 278 per cent. These figures show that in mail tonnage, after allowance is made for mail handled at branch stations, railroad depots and other places outside of the main postoffice, there has been in the main postoffice an increase of 91 per cent in mail tonnage with only 14 per cent increase in space.

It is only by forcibly calling attention to such conditions that a remedy for them can be found, and the above is written as a slight contribution to the publicity which must be given the subject. Anyone who wants to help can do so very effectively by addressing Senators and Congressmen from his state.

C. A. TUPPER, President,
International Trade Press, Inc.,
Chicago, Ill.

FINANCIAL NEWS

Comment on the Financial Outlook in the Electrical Industry, New Securities, Reports of Earnings, Dividends and Utility Stocks

Electric Welding Co. Declares Cash and Stock Dividends.

The Electric Welding Co. of America of Baltimore, Md., declared dividends on its preferred stock for the eight months ended Dec. 31, 1919, of 6% cash, or at the rate of 8% per annum—and on its common stock 10% cash and 25% in stock, payable to holders of record March 15. The Electric Welding Co. of Boston, Inc., declared dividends for the six months ended Dec. 31, 1919, on its preferred stock of 3½% in cash, and on its common stock 6% in cash and 50% in stock, payable to holders of record March 15.

Montreal Tramways Pays 2½ Per Cent in Back Dividends.

The Montreal Tramways Co., Montreal, Que., has declared a dividend of 2% applicable to back dividends. This makes a total of 5% paid on accumulated dividends and leaves 12½% still to be paid.

Figures on Trade Balances.

Department of Commerce January figures show that the South American republics, Asia, Africa and Mexico had a trade balance against the United States of $220,437,983 for the month and of $665,156,801 for the seven months of the Government fiscal year. The January balance against Europe was $356,155,889.

Keystone Telephone Co.

The combined profit and loss account of the Keystone Telephone Co. of Philadelphia, the Keystone Telephone Co. (of New Jersey) and Eastern Telephone and Telegraph Co. for year ended Dec. 31, 1919, compares with year 1918 as follows:

	1919.	1918.
Gross	$1,656,449	$1,605,721
Net after expenses	560,522	664,042
Surplus*	6,735	8,620
Preferred dividends	58,105	116,211
Previous surplus	933,792	973,593
Profit and loss surp.	882,423	933,792

*After interest charges, bond discount and renewal reserve.

Commonwealth Power Co.

Earnings of the Commonwealth Power, Railway & Light Co. for January and the 12 months ended Jan. 31, 1920, compares with 1919 as follows:

	1920.	1919.
January gross	$2,598,959	$2,149,553
Net after taxes	352,710	236,924
Bal. after pfd. divs.	262,945	147,159
12 months' gross	26,414,305	22,367,144
Net after taxes	2,534,914	1,274,138
Bal. after pfd. divs.	1,457,734	196,958

Benjamin Electric Manufacturing Co. Seeks Stock Tenders.

Benjamin Electric Manufacturing Co., Chicago, will receive tenders of 8% first preferred stock, under provisions of the company's sinking fund, sufficient to exhaust the sum of $33,575, until noon on March 27. All tenders must be made at the general office of the company, Chicago.

Central Illinois Public Service.

For the year ended Dec. 31, 1919, the Central Illinois Public Service Co. shows the following:

	1919.	1918.
Gross earnings	$4,113,619	$2,913,070
Net income	265,965	239,751
Surplus for year	35,835	73,320
Total surplus	273,563	204,299

ALABAMA TRACTION, LIGHT & POWER CO.

Earnings of Alabama Power Co., operating subsidiary, compare as follows for November and 12 months ended Nov. 30:

	1919.	1918.
November gross	$ 289,411	$ 293,552
Net earnings	145,409	142,537
12 months' gross	3,094,985	2,925,021
Net earnings	1,728,802	1,548,972

Puget Sound Traction, Light & Power Co.

Earnings of the Puget Sound Traction, Light & Power Co. for December and the 12 months ended December 31, 1919, are as follows:

December gross	$ 890,474
Net earnings	389,153
Surplus after charges	240,921
12 months' gross	9,770,666
Net earnings	3,285,964
Surplus after charges	1,349,797

Southern Bell Telephone Co.

For the year ended Dec. 31, 1919, Southern Bell Telephone and Telegraph Co. reports net income after all charges of $1,844,056.

Cumberland Telephone Co.

Report for the year ended Dec. 31, 1919, of the Cumberland Telephone Co., shows surplus after all charges and taxes of $1,015,385, equivalent to $6.87 a share ($100 par value) earned on the $14,773,450 capital stock.

Railroads Need $6,000,000,000.

Railroad officials estimate that $6,000,000,000 for equipment and betterments will be needed during the next three years by railroads.

Dividends.

Western Union Telegraph Co. has declared its usual quarterly dividend of 1¾%, payable April 15 to stockholders of record March 20.

Duluth-Superior Traction Co. has declared its regular quarterly dividend of $1 a share on its preferred stock, payable April 1 to stockholders of record March 15.

Twin City Rapid Transit Co. has declared its regular quarterly dividend of $1.75 a share on its preferred stock, payable April 10 to stockholders of record March 15.

Calumet & Hecla Mining Co. has omitted the usual dividend to be declared at this time. In the last quarter of 1919 the company paid $5 per share, bringing the year's rate up to $10. Rising costs and inability to market its copper prevented the payment of this dividend.

The El Paso Electric Co. paid a quarterly dividend of $2.50 on the common stock March 15 to stockholders of record March 9.

The Asheville (N. C.) Power & Light Co. has declared its regular quarterly dividend of 1¾% on the preferred stock, payable April 1 to stockholders of record March 18.

The Bell Telephone Co. of Canada has declared its regular quarterly dividend of 2%, payable April 15 to stockholders of record March 31.

The American Gas & Electric Co. has declared its regular quarterly dividend of 2½% on the common stock, payable April 1 to stockholders of record March 16. The regular quarterly dividend of 1½% on the preferred stock was declared payable May 1 to stockholders of record April 17.

WEEKLY COMPARISON OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeiler & Co., Rookery Bldg., Chicago.

Public Utilities.	Div. rate. Per cent.	Bid Mar. 9.	Bid Mar. 16.
Adirondack Electric Power of Glens Falls, common	6	12	12
Adirondack Electric Power of Glens Falls, preferred	6	77	78
American Gas & Electric of New York, common	10+extra	119	119
American Gas & Electric of New York, preferred	6	38	38
American Light & Traction of New York, common	..	180	192
American Light & Traction of New York, preferred	6	88	89
American Power & Light of New York, common	4	58	59
American Power & Light of New York, preferred	6	69	69
American Public Utilities of Grand Rapids, common	..	3	4
American Public Utilities of Grand Rapids, preferred	7	20	20
American Telephone & Telegraph of New York	..	99	99½
American Water Works & Elec. of New York, common	..	2	3
American Water Works & Elec. of New York, particip	7	4	4
American Water Works & Elec. of New York, first preferred	..	47	48
Appalachian Power, common	..	2	3
Appalachian Power, preferred	7	20	21
Cities Service of New York, common	+extra	390	380
Cities Service of New York, preferred	6	71	70
Commonwealth Edison of Chicago	8	106¼	106
Comm. Power, Railway & Light of Jackson, common	..	18	18
Comm. Power, Railway & Light of Jackson, preferred	6	37½	37
Federal Light & Traction of New York, common	..	5	5
Federal Light & Traction of New York, preferred	..	42	46
Middle West Utilities of Chicago, common	..	18	18
Middle West Utilities of Chicago, preferred	..	38	38
Northern States Power of Chicago, common	..	45	50
Northern States Power of Chicago, preferred	ex.div.7	83	84
Pacific Gas & Electric of San Francisco, common	..	45	47
Pulbic Service of Northern Illinois, Chicago, common	7	74	74
Public Service of Northern Illinois, Chicago, preferred	6	85	85
Republic Railway & Light of Youngstown, common	4	13	19
Republic Railway & Light of Youngstown, preferred	6	47	53
Standard Gas & Electric of Chicago, common	..	17½	18
Standard Gas & Electric of Chicago, preferred	6	38½	38
Tennessee Railway, Light & Power of Chattanooga, common	..	1	1½
Tennessee Railway, Light & Power of Chattanooga, preferred	6	7	7½
United Light & Railways of Grand Rapids, common	4	25	26
United Light & Railways of Grand Rapids, preferred	6	61½	64
Western Power of San Francisco, common	..	17	18
Western Union Telegraph of New York	extra	85⅛	87
Industries.			
Electric Storage of Philadelphia, common	4	110	105
General Electric of Schenectady	8	168	170
Westinghouse Electric & Mfg. of Pittsburgh, common	7	52	52